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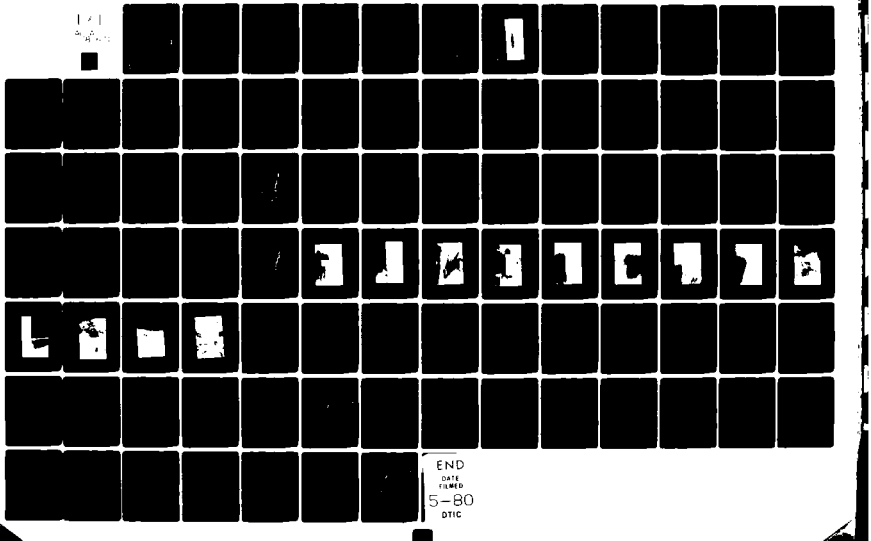

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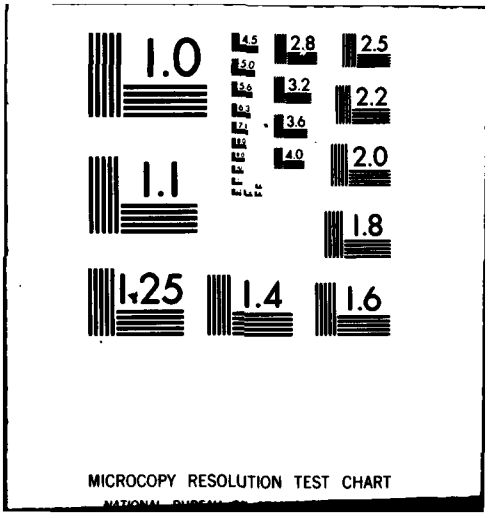
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DELAWARE RIVER BASIN

QUEEN ANNE CREEK, BUCKS COUNTY

PENNSYLVANIA

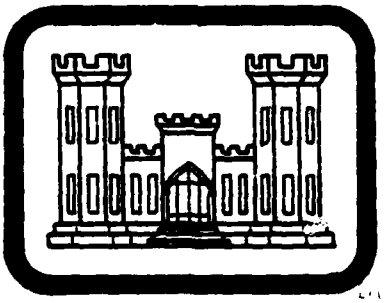
NDS ID PA. 00801

DER ID 9-171

OXFORD VALLEY MALL DAM

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DACW31-80-C-0018



DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

JANUARY 1980

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DELAWARE RIVER BASIN

(6) National Dam Inspection Program

OXFORD VALLEY MALL DAM, Delaware River Basin

Queen Ann Creek, BUCKS COUNTY, PENNSYLVANIA.

(NDS-I.D. Number No. PA-00801,
DER-I.D. Number -9-171)

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

(15) DACW31-80-C-0010

Prepared by:

WOODWARD-CLYDE CONSULTANTS
5120 Butler Pike
Plymouth Meeting, Pennsylvania 19462

Submitted to:

DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland 21203

(11) JANUARY 1980

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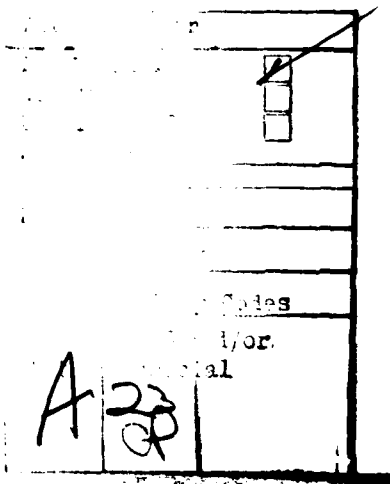
PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to expeditiously identify those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.



PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	Oxford Valley Mall Dam
County Located:	Bucks County
State Located:	Pennsylvania
Stream:	Queen Anne Creek
Coordinates:	Latitude 40° 11.0'
	Longitude 74° 52.5'
Date of Inspection:	October 25, 1979

Oxford Valley Mall Dam is owned by Bucks Associates and maintained by Oxford Valley Mall employees. The dam and reservoir are used to control storm water runoff from the adjacent Oxford Valley Mall. The dam was designed and constructed as part of the overall mall development and was completed in May 1973.

The dam and its appurtenant facilities are considered to be in good condition, with the reservations noted below. The dam is classified as a "Small" size structure with a "High" hazard classification, consistent with its potential in the event of failure for extensive property damage and loss of life in the downstream shopping area, Lincoln Plaza.

Calculations indicate that the existing spillway system discharges about 46 percent of the Probable Maximum Flood (PMF), less than one-half the PMF, without overtopping. It is assessed that the embankment would probably withstand overtopping for a limited period. Therefore, the spillway system of this structure is considered to be "Inadequate" but not "Seriously Inadequate".

The visual inspection and review of available documentation indicates that the dam, foundation and its appurtenant structures are in generally good condition. Although some erosion and foot traffic damage has occurred to the embankment, the items of major concern are the new construction at the left abutment, with the apparent lowering of the top of the dam, and the recent planting of trees on the upstream slope.

In order to maintain the overall good condition of the dam, the recommendations following should be implemented immediately.

1. A detailed survey should be performed at the site of the new construction to insure that there are no low spots which would reduce the maximum possible level of the reservoir.

2. The recently planted trees on the upstream embankment slope should be removed and the embankment returned to its original condition.

The following recommendations should be performed as soon as practical.

1. The crest should be reseeded.

2. The open joints of the transition section should be sealed.

3. A study should be made by a registered professional engineer experienced in the design of dams to determine the best method of increasing the spillway capacity to meet current hydrologic/hydraulic criteria.

Because of the location of the dam and the potential for heavy property damage and possible loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents and businesses if high flows are expected and provisions for evacuating these people in the event of an emergency. In addition, an operation and maintenance procedure should be developed to insure that all pertinent items are carefully inspected on a regular basis and maintained in the best possible condition.

Mary F. Beck — Feb. 7, 1980

Mary F. Beck, P.E. — Date
Pennsylvania Registration 27447E
Woodward-Clyde Consultants

2/7/80

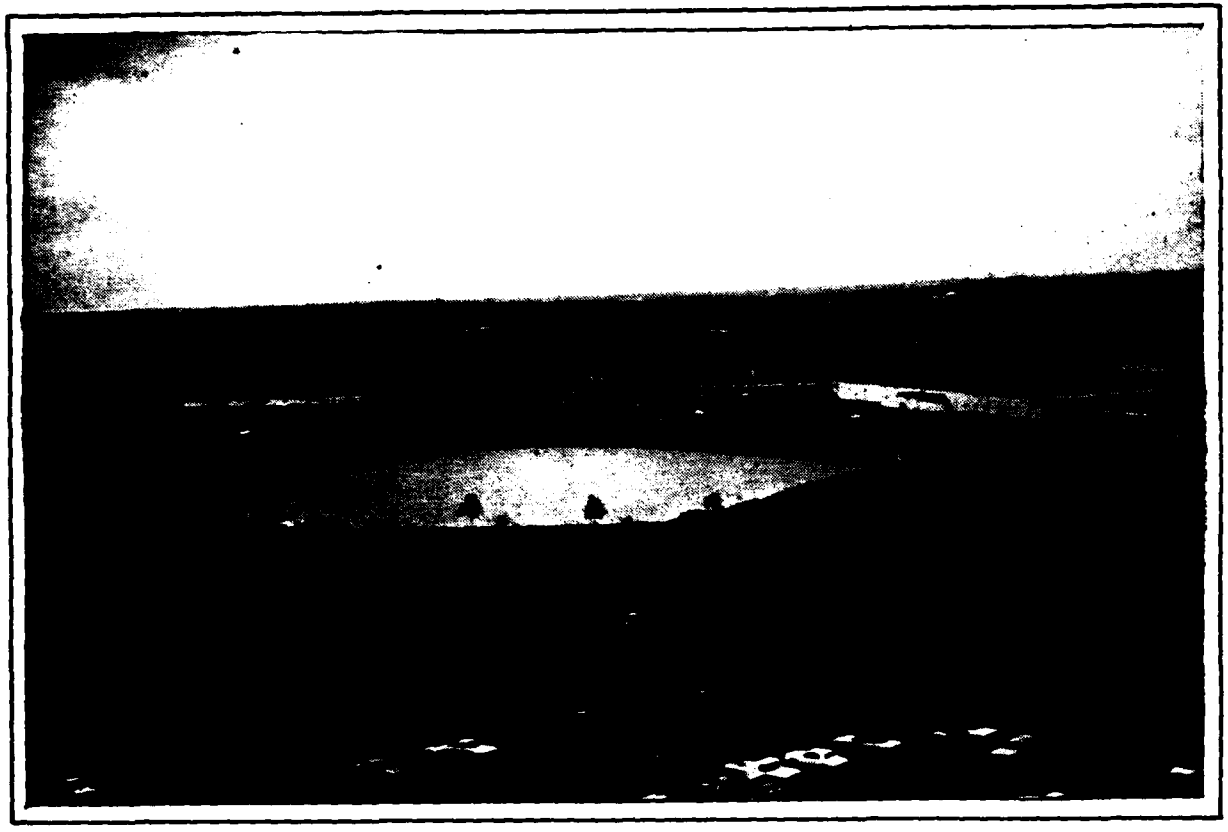
John H. Frederick, Jr., P.E. — Date
Maryland Registration 7301
Woodward-Clyde Consultants

STATE OF MARYLAND
John Henry Frederick, Jr.
No. 7301
REGISTERED PROFESSIONAL ENGINEER

APPROVED BY:

20 March 80

THOMAS A. RHEN — Date
LTC, Corps of Engineers
Acting District Engineer



OVERVIEW
OXFORD VALLEY MALL DAM, BUCKS COUNTY, PENNSYLVANIA

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PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM
OXFORD VALLEY MALL DAM
NATIONAL ID NO. PA 00801
DER NO. 9-171

SECTION 1
PROJECT INFORMATION

1.1 General.

a. Authority. The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

b. Purpose. The purpose of the inspection is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Oxford Valley Mall Dam is a homogeneous earth embankment about 1,200 feet long. The height, measured from the top of the embankment to the toe of the impervious fill, is about 27 feet. However, fill extending from the embankment to U.S. Route 1, a distance of about 850 feet, has reduced the apparent height of the embankment to about 13 feet. No internal drains are incorporated in the embankment. The design upstream and downstream slopes of the embankment are 4H:1V and are protected with vegetation. The design crest width is 20 feet at the 142 contour, the embankment being constructed to elevation 143 to allow for settlement. The eight acre reservoir was formed by excavation to elevation 115 at the reservoir drain inlet. Plan and section views are shown on Plates 2, 3 and 4, Appendix E.

The spillway consists of an octagonal reinforced concrete intake tower, 851 feet of an eight foot wide by eight foot high conduit and a transition section at the outlet. There are six anti-seep collars on the conduit under the impervious fill. Water from the impounded stream normally flows through two orifices at elevation 120.0. During large storm events, water will be stored up to the top of the tower, elevation 138.0, and flow over its open top. The pond drain inlet invert elevation is 115.0. All water from the dam flows through the discharge conduit and through a 12.5 foot long

transition section before entering a culvert under U.S. Route 1. There are no other spillways for this structure.

b. Location. The dam is located on Queen Anne Creek in Middletown Township, Bucks County, Pennsylvania. The dam site is located 1.8 miles northeast of the intersection of U.S. Route 1 and Interstate 95. The dam site and reservoir are located on USGS Quadrangle maps entitled "Langhorne, Pennsylvania" and "Trenton West, Pennsylvania - New Jersey", at coordinates N 40° 11.0' W 74° 52.5'. A regional location plan of Oxford Valley Mall Dam and reservoir is included as Plate 1, Appendix E.

c. Size Classification. The dam is classified as a "Small" size dam by virtue of its 27 foot height and 308 acre-feet total storage capacity.

d. Hazard Classification. A "High" hazard classification is assigned consistent with the potential to cause property damage and loss of life in a shopping center, Lincoln Plaza, immediately downstream of the dam. The main shopping center, Oxford Valley Mall, is located west, or to the right, of the dam.

e. Ownership. Oxford Valley Mall Dam is owned by Bucks Associates. All correspondence should be addressed to Mr. Tom Schroeder, Operations Manager, 228 Oxford Valley Mall, One Oxford Valley, Langhorne, Pennsylvania 19047.

f. Purpose of Dam. The purpose of this dam is to control storm water runoff from the adjacent Oxford Valley Mall.

g. Design and Construction History. In January 1972, representatives from Meridian Engineering, Inc.; Cope Linder Walmsley, Architects & Engineers; and Pickering, Corts & Summerson, Inc., Consulting Engineers, met with representatives of the Pennsylvania Department of Environmental Resources (DER) to discuss the requirements for a retention pond controlling surface runoff from the proposed mall. By April 1972, preliminary calculations and plans were submitted to DER. In July, revised plans were submitted and an application made for a permit. Construction was well underway in October 1972, with approximately 75 percent of the lake excavated, and the conduit and tower footer and slab installed. Construction continued through the winter with slight delays because of the weather. Design elevation of the dam was reached on April 20, 1973, with topsoil placement being completed on May 1, 1973. The sluice gate was installed and water was ponded to the design elevation of 120 by May 14. The alignment and settlement monuments shown on the plans were not installed as of January 27, 1975, and probably have not been installed to date.

The dam was constructed as part of the larger mall development project. Meridian Engineering was the project manager; Pickering, Corts & Summerson designed the structure and inspected the excavated subgrade. Meridian Engineering also inspected the subgrade and inspected rebar placement in the tower and conduit. Ambric Testing Laboratories performed concrete strength tests; Site Engineers did the original soils and foundation investigation, and provided daily inspection of backfill and compaction testing. DER representatives also visited the site during construction.

By October 1979, construction was well underway for a new project, called Sesame Street, located on the left abutment of the dam. The grading plan, enclosed as Plate 7, Appendix E, discloses that the new construction encroaches slightly on the reservoir area. The plan also indicates the upper end of the reservoir was not constructed exactly as designed.

h. Normal Operating Procedures. Under normal conditions, the pond drain gate is closed and water flows through the orifices into the intake tower and then through the eight foot square discharge conduit. Excess storm water is stored to the top of the intake tower, elevation 138.0. Discharge from storms with a return period greater than 100 years enters the top of the tower and discharges through the conduit. No minimum flow downstream is required for this structure.

1.3 Pertinent Data.

A summary of pertinent data for Oxford Valley Mall Dam is presented as follows.

a.	Drainage Area (square miles)	0.97
b.	Discharge at Dam Site (cfs)	
	Maximum Known Flood at Dam Site	Unknown
	At Top of Dam (design)	1,611
	At Top of Dam (existing)	1,558
c.	Elevation (feet above MSL)	
	Top of Dam	
	Constructed (design)	143.0
	Settled (design)	142.0
	Measured	141.9
	Top of Riser	138.0
	Low Stage Intakes	120.0
	Pond Drain Inlet	115.0
	Outlet of Discharge Transition	104.22

d.	Reservoir (feet)	
	Length at Normal Pool	850
	Length at Top of Dam	1,800
e.	Storage (acre-feet)	
	At Low Stage	34
	To Top of Dam (142 feet)	310
f.	Reservoir Surface Area (acres)	
	Normal Pool	7.7
	Top of Dam (142)	16.9
g.	Dam Data	
	Type	Homogeneous earth fill
	Volume	100,000 cu yds
	Length(1)	1,200 feet
	Maximum Height	27 feet
	Top Width	
	Design at 142 Contour	20 feet
	Measured	12 feet
	Side Slopes	
	Upstream	
	Design	4H:1V
	Measured	4.7H:1V
	Downstream	
	Design	4H:1V
	Measured	3.2H:1V
	Cutoff	None
	Grout Curtain	None
h.	Spillway	
	Type	Open top drop inlet tower; 851 ft long, 8 ft x 8 ft concrete conduit & transition outlet section
	Reservoir Drain	Sluice gate on tower and 20 ft long 30" ductile iron pipe
	Elevations (feet)	
	Weir	138.0
	Low Stage Inlets	120.0
	Pond Drain	115.0
	Conduit Outlet Invert	104.22
	Energy Dissipator	Hydraulic jump forms in transition section

(1) Measured between the original 142 contour on each abutment.

SECTION 2
ENGINEERING DATA

2.1 Design.

a. Data Available. A summary of the available engineering data on Oxford Valley Mall Dam is attached as Appendix B. Engineering data contained in Pennsylvania Department of Environmental Resources (DER) files and available for review included a hydrology study, a hydraulic design and a revised hydraulic design, soil study, plans and concrete pipe specifications. Calculations and plans were prepared by Pickering, Corts & Summerson, Inc. In addition, other data included the "Report Upon the Application" of Bucks Associates, dated October 4, 1972. Other documentation included miscellaneous letters, correspondence, photographs and progress reports prepared by DER and Meridian Engineers, the project manager.

b. Design Features. The principal design features of Oxford Valley Mall Dam are illustrated on the plans and profiles enclosed in Appendix E as Plates 2 through 6. These plates were reproduced from drawings supplied by the Owner's representative. Plate 7 is a portion of a drawing supplied by the Owner's architect. A detailed description of the design features is also presented in Section 1.2, paragraph a, and pertinent data relative to the structure is presented in Section 1.3.

2.2 Construction.

Details of construction are presented in Section 1.2, paragraph g. Construction records used for the review of this project were included in DER files located in Harrisburg, Pennsylvania.

2.3 Operational Data.

There are no operational records maintained. No water level measurements or rainfall records are maintained within this watershed.

2.4 Evaluation.

a. Availability. All engineering data evaluated and reproduced for this report were provided by DER and supplemented by the Owner's representative or architect.

b. Adequacy. Data included in State files are considered adequate to evaluate the dam and appurtenant structures.

c. Validity. There is no reason to question the validity of this data.

SECTION 3
VISUAL INSPECTION

3.1 Findings.

a. General. Observations and comments of the field inspection team are contained in the checklist enclosed herein as Appendix A, and are summarized and evaluated as follows. In general, the dam and its appurtenant structures are considered to be in good condition.

b. Dam. During the visual inspection, there were no indications of distortion in alignment or grade that would be indicative of movement of the embankment or foundation. Vegetative cover on the embankment is considered in good condition, with the exception of the crest near the left abutment and in the area of new construction on the left abutment, as shown in Photographs No. 5 and No. 6. It appears that the crest was raised slightly in the vicinity of the left abutment, and regraded areas on the left reservoir slope had recently been seeded. The embankment has been damaged along the shoreline, either as a result of erosion or foot traffic, as shown in Photograph No. 11. Also, some minor erosion, probably as a result of foot traffic, has occurred around the intake tower, as shown in Photograph No. 9. At this time, the amount of erosion is not significant.

The embankment crest is considered to be in good condition, except near the left abutment where reseeding is necessary. The crest measures approximately 12 feet wide, and the measured upstream and downstream slopes were 4.7H:1V and 3.2H:1V, respectively. The crest is approximately 13 feet above the downstream toe, as shown in Photograph No. 8, and about 27 feet above the upstream toe of the impervious embankment. The horizontal alignment was checked and found to be satisfactory. The vertical alignment was checked and was found to range from a low of 141.9 to a high of 143.1. See Plate 3, Appendix E. At the time of inspection, grading for a new parking lot on the left embankment had been done. The storm inlet was about five feet below the top of the dam.

Junctions between the embankment and abutment are judged to be in good condition, with no excessive erosion or deterioration. It is noted that the soils around the reservoir area do not appear to be erosion resistant. A large gully has formed at the outlet of the storm sewer from the mall, as shown in Photograph No. 12. Reportedly, the end section of the storm sewer was replaced after it had fallen off because of the loss of support from the soils being washed away from under it. Gullies ranging from a foot to more than

three feet deep have also formed at the upper end of the reservoir as a result of surface water runoff.

There was no seepage observed, although it is to be noted that the maximum water depth in the reservoir is only five feet. The normal pool level is about nine feet below the downstream toe of the dam; thus, no seepage would be expected.

A large, small animal hole was noted in the reservoir side slope, as shown in Photograph No. 13. While the burrow has no effect on the stability of the structure at this location, the embankment should be inspected periodically to insure that animals do not burrow into it.

A visit to the dam in January 1980 revealed the recent planting of about 60 eight to ten foot high trees on the upstream slope of the embankment. These should be removed.

c. Appurtenant Structures.

1. Spillway. As shown on Photograph No. 1, the intake tower is located within the upstream slope at the shoreline. The exposed portions of the exterior and interior of the tower were inspected and evaluated to be in good condition with no signs of excessive concrete deterioration, spalling or other structural deficiencies or defects. Minor honeycombing of the concrete was observed and the forms apparently deflected during construction, as shown in Photograph No. 10. The pond drain sluice gate is located on the inside of the tower and seats completely. The interior of the discharge conduit was inspected and found to be in good condition, with some slight leaks through the top and sides and leachate stalactites.

The exposed portions of the transition structure at the end of the conduit were inspected and found to be in generally good condition. The joints between the head wall and wing walls have opened and should be sealed.

d. Reservoir. At the time of the inspection, the pond was at the normal pool elevation, the level of the orifices in the intake tower. The reservoir slopes are fairly well vegetated to the water's edge, and very little debris was noted. Because of the gullying at the upper end of the reservoir, sediment was noted at the upper end of the reservoir. This should have little effect on flood storage capacity. At the time of the inspection, it was noted that the configuration at the upper end of the reservoir appeared different than the design drawings. This was confirmed by the grading plan developed for the Sesame Street project.

e. Downstream Channel. As shown in the overview and Photograph No. 2, immediately downstream of the structure is a shopping area called Lincoln Plaza. The 851 foot long discharge conduit passes under this shopping area and discharges under U.S. Route 1, as shown in Photograph No. 4. Immediately below U.S. Route 1, the eight foot wide Queen Anne Creek meanders through a lightly wooded floodplain with heavy underbrush. In the next four miles, Queen Anne Creek passes through several residential areas before entering Mill Creek. In the event of failure, excessive property damage and possible loss of life is likely, justifying a "High" hazard classification.

3.2 Evaluation.

Inspection of the dam and appurtenant facilities disclosed no evidence of apparent past or present movement that would indicate existing instability of the dam or spillway system. The spillway, including the interior of the discharge conduit, was inspected and found to be in good condition. Although some erosion and foot traffic damage has occurred to the embankment, the item of major concern is the new construction at the left abutment. After construction is completed, the area should be carefully surveyed to insure that a crest elevation of at least 142 is maintained.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures.

Operation of the dam does not require a dam tender. Under normal conditions, flow discharges through the orifices in the intake tower and through the eight foot square discharge conduit under the shopping area. Excess water is stored up to elevation 138.0 and then discharged over the top of the tower.

4.2 Maintenance of the Dam.

The dam is maintained by the Oxford Valley Mall maintenance personnel. The dam is visually inspected after every heavy rainfall.

4.3 Maintenance of Operating Facilities.

Maintenance of these facilities includes cleaning debris from the trash rack and occasional operation of the sluice gate.

4.4 Warning Systems In Effect.

There is no written warning system in effect. The Owner's representative indicated that in the event a problem developed, they would notify the local police and the Mall security office.

4.5 Evaluation.

It is judged that the current operating procedure, which does not require a dam tender, is a realistic means of operating the relatively simple control facilities of Oxford Valley Mall Dam.

In conclusion, it is noted that formal operational, maintenance and warning procedures should be developed and implemented as soon as practical. It should be noted that these procedures should include an inspection checklist, which would include a listing of items to be checked during each inspection and repaired as necessary to insure proper performance of the structure.

SECTION 5
HYDROLOGY/HYDRAULICS

5.1 Evaluation of Features.

a. Design Data. As shown on Plate 1, Appendix E, the watershed is irregularly shaped, having a long dimension of 1.9 miles and a short dimension ranging from 0.4 to 0.8 mile, with a total drainage area of approximately 0.97 square mile. Elevations within the watershed range from about 210 in the upper reaches to 120 at the normal pool elevation. About 30 percent of the watershed is developed with the mall and shopping center. Other development is limited, but can be expected to continue.

The original design information available for review from the Department of Environmental Resources' files included a hydrology study composed of 17 pages of computer printout and hydraulic and revised hydraulic designs. The structure was designed to store the runoff volume from a 100 year, 48 hour storm between the orifices at elevation 120.0 and the top of the intake tower at elevation 138.0. The spillway capacity, neglecting flow through the orifices, with the reservoir level at the top of the dam was designed to be equal to the Department of Forests and Waters' "C" curve value, 1,540 cfs.

In accordance with criteria established by Federal (OCE) Guidelines, the selected spillway design flood for this "Small" size dam and "High" hazard classification is one-half the Probable Maximum Flood (PMF).

b. Experience Data. There are no records of reservoir levels or rainfalls kept for this dam. There are no estimates or records of previous high water levels.

c. Visual Observations. On the date of the inspection, the only condition observed that might indicate a possible reduction in spillway capacity is the possible lowering of the elevation of the dam crest as a result of the new construction at the left abutment. Observations regarding the condition of the downstream channel, spillway and reservoir are located in Appendix A and are discussed in greater detail in Section 3.

d. Overtopping Potential. The original hydrology study included a determination of the probable maximum inflow hydrograph based on the Soil Conservation Service's (SCS) methods. A copy of this hydrograph is included in Appendix D. Because no flood routing was available and because of the difference in the rainfall distribution pattern between the SCS method and the criteria established for this Phase I investigation, the overtopping potential of this dam was

estimated using the HEC-1, Dam Safety Version, computer program. A brief description of the program is also included in Appendix D. The original hydraulic calculations were reviewed and found to be adequate. As noted in Section 3, the reservoir surface area at normal pool is somewhat smaller than the design value. The capacity of the reservoir was estimated from existing conditions and was not found to differ appreciably from the design values.

Calculations for this investigation essentially confirm the spillway evaluation with an estimated discharge of about 1,610 cfs at the design high water elevation at the top of the dam. The HEC-1 program computed 50 percent of the PMF inflow to be about 1,870 cfs. The spillway can discharge about 0.46 PMF without overtopping the embankment, thus the spillway capacity is judged "Inadequate". The areas where the reservoir first overflows are over the abutments where the top width is much wider than 12 feet. It was assumed that the maximum section could withstand overtopping of less than one foot for one hour or less. Based on the assumed failure criteria, the 0.5 PMF overtops the embankment, but it is assessed not to cause failure. Therefore, the spillway is not judged "Seriously Inadequate".

e. Downstream Conditions. As noted in Section 3, the first downstream damage center, Lincoln Plaza, is located over the discharge conduit. Therefore, Lincoln Plaza can be damaged only in the event the embankment is overtopped or fails. Discharge from the conduit flows through several residential areas before entering Mill Creek, four miles downstream. In the event of failure during an extreme event, excessive property damage and possible loss of life is likely, justifying a "High" hazard classification.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability.

a. Visual Observations. Visual observations detected no evidence of existing or pending embankment or spillway instability. Upstream and downstream slopes of the embankment appear to be stable and in generally good condition prior to planting of the trees noted in Section 3. The upstream slope has suffered erosion or damage from foot traffic around the intake tower and along the waterline, which at the present time is not critical.

b. Design and Construction Data. A stability analysis of the maximum section was performed by Pickering, Corts & Summerson, Inc. The analysis considered an embankment 27 feet in height, both upstream and downstream, with 4H:1V side slopes. The upstream slope was analyzed for full rapid drawdown and the downstream slope for steady seepage. The pond level in both cases was assumed to be the top of the dam, elevation 142.0.

The soil strength parameters were based on one consolidated drained triaxial compression test series performed by Site Engineers, Inc. The data indicate that the test was performed on "remolded" on-site sandy silt/silty sand soil. The results were a relatively high angle of friction of 34 degrees and cohesion of 1,200 pounds per square foot. The degree of compaction for the test specimens was not given. Construction specifications required a field degree of compaction of 98 percent of Standard Proctor dry density, ASTM D 698.

The method of stability analysis was a simplified sliding wedge analysis presented in Engineering For Dams, Volume III, by Creager, Justin & Hinds. The computed upstream factor of safety was 7.10, and the downstream factor of safety was 9.17.

Had a more rigorous method of stability analysis been performed, such as the Swedish Circle Method, the computed factors of safety would have been lower, but it is concluded that they would still be acceptable. Documentation concerning in-place density test results was not available for review. An inspection report by DER indicated that "several inspections at this site have disclosed some poor construction practices, especially in the placement and compaction of fill material." Therefore, it is possible that the actual soil strength is considerably less than the basis for design. However, since the downstream height of the embankment is only

about 13 feet and since the constructed slopes are relatively flat, it is concluded that overall the stability of the embankment is adequate.

c. Operating Records. There are no operational records for this structure.

d. Post-Construction Changes. There are no reports, nor is there any evidence, that modifications were made to this dam that would affect the stability of the embankment. The new construction at the left embankment may affect the possibility of the structure being overtopped.

e. Seismic Stability. The dam is located in Seismic Zone 1. Normally it can be considered that if a dam in this zone is stable under static loading conditions, it can be assumed safe for any expected earthquake conditions. As the static stability analysis is considered adequate, it can be assumed that the seismic stability requirements are satisfied.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment.

a. Evaluation. Visual inspection and review of design and construction documentation indicate that the dam, foundation and spillway structure of Oxford Valley Mall Dam are in good condition. The hydrologic and hydraulic computations presented in Appendix D indicate that the structure will pass about 46 percent of the Probable Maximum Flood (PMF), less than one-half of the PMF, without overtopping. It is assessed that the embankment would probably withstand overtopping for a limited period; therefore, the spillway system of this structure is considered to be "Inadequate" but not "Seriously Inadequate". In the event that the dam failed rapidly at full pool, extreme property damage and possible loss of life would be expected, thus justifying the "High" hazard classification.

b. Adequacy of Information. Information available from DER files and the visual inspection is sufficiently adequate to evaluate the structural and hydraulic aspects of the dam and spillway.

c. Urgency. It is recommended that the measures presented in Section 7.2 be implemented as specified.

7.2 Remedial Measures.

a. Facilities. It is recommended that the following measures be implemented immediately.

1. A detailed survey should be performed at the site of the new construction to insure that there are no low spots which would reduce the maximum possible level of the reservoir.

2. The recently planted trees on the upstream embankment slope should be removed and the embankment restored to its original condition.

The following should be performed as soon as practical.

1. The crest should be reseeded.

2. The open joints of the transition section should be sealed.

3. A study should be made by a registered professional engineer experienced in the design of dams to

determine the best method of increasing the spillway capacity to meet current hydrologic/hydraulic criteria.

b. Operation and Maintenance Procedures. Because of the location of the dam and the potential for heavy property damage and possible loss of life in the event of failure, a formal procedure of observation and warning during periods of high precipitation should be developed and implemented. This procedure should include a method of warning downstream residents and businesses if high flows are expected and provisions for evacuating these people in the event of an emergency. In addition, an operation and maintenance procedure should also be developed to insure that all pertinent items are carefuly inspected on a regular basis and maintained in the best possible condition.

APPENDIX

A

CHECK LIST
VISUAL INSPECTION
PHASE I

Name Dam *Oxford Valley Mall Dam* County *Bucks* State *Pennsylvania* National ID # *PA 00801*

Type of Dam *Earth* Hazard Category *High*

Date(s) Inspection *10/25/1979* Weather *partly cloudy* Temperature *Cool*

Pool Elevation at Time of Inspection *120.2* M.S.L. Tailwater at Time of Inspection *N/A* M.S.L.

Inspection Personnel:

Mary F. Beck (Hydrologist) *Vincent McKeever (Hydrologist)*

Arthur H. Dvinoff (Geotechnical/Civil)

Raymond S. Lambert (Geologist)

11/30/ 79

Mary F. Beck Recorder

Remarks:

Mr. Tom Schroeder, Operations Manager for the Mall, provided information at the time of the inspection.

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
ANY NOTICEABLE SEEPAGE	N/A	
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	N/A	
DRAINS	N/A	
WATER PASSAGES	N/A	
FOUNDATION	N/A	

CONCRETE/MASONRY DAMS

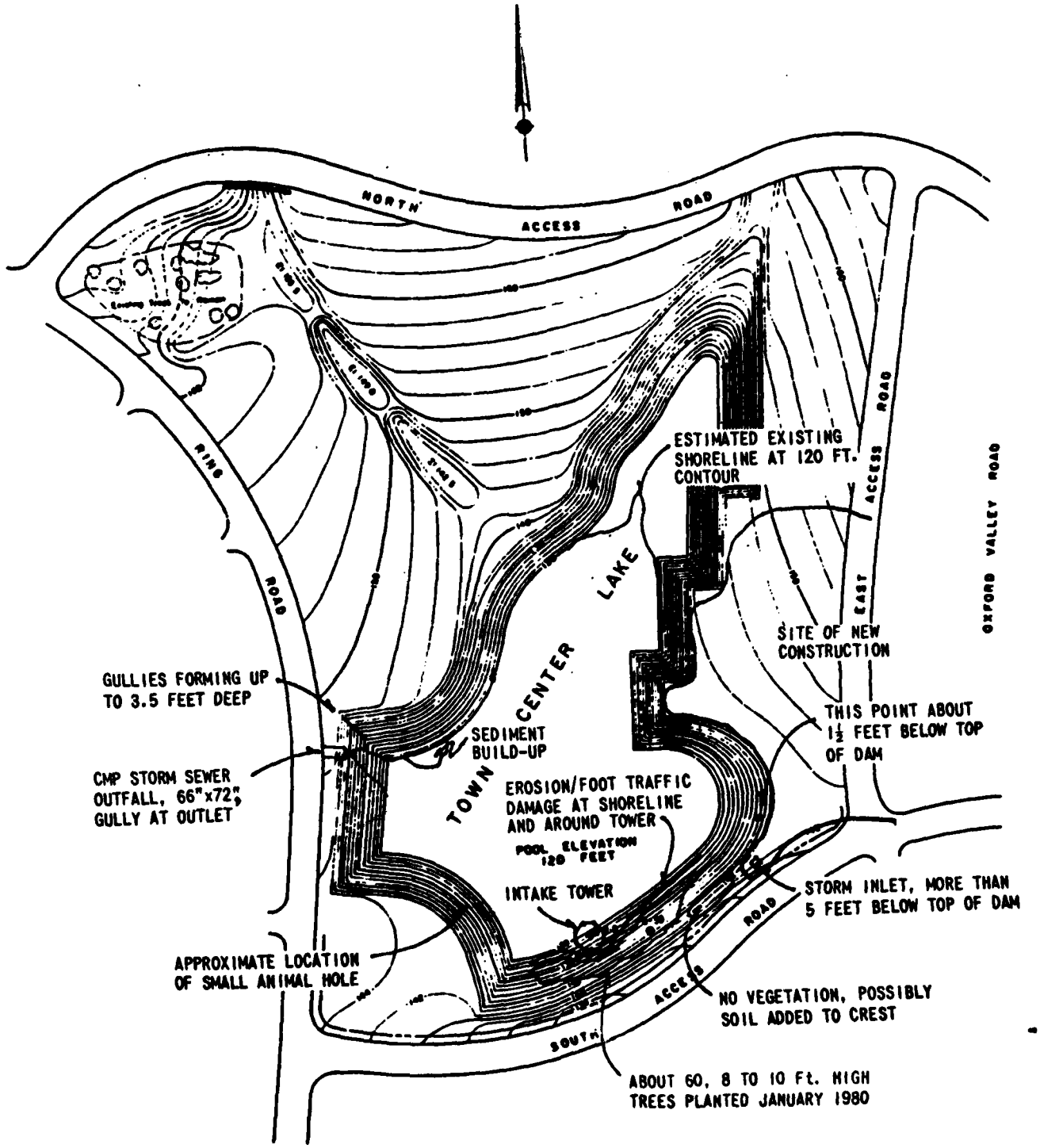
VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	N/A	
STRUCTURAL CRACKING	N/A	
VERTICAL AND HORIZONTAL ALIGNMENT	N/A	
MONOLITH JOINTS	N/A	
CONSTRUCTION JOINTS	N/A	

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	*None observed.*	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	*None observed.*	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	*The upstream slope at the water line shows minor erosion/foot traffic damage.*	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	*Vertical and horizontal alignment appeared good, but new construction in progress at the left abutment could lower the crest elevation.*	
RIPRAP FAILURES	*N/A - no riprap*	

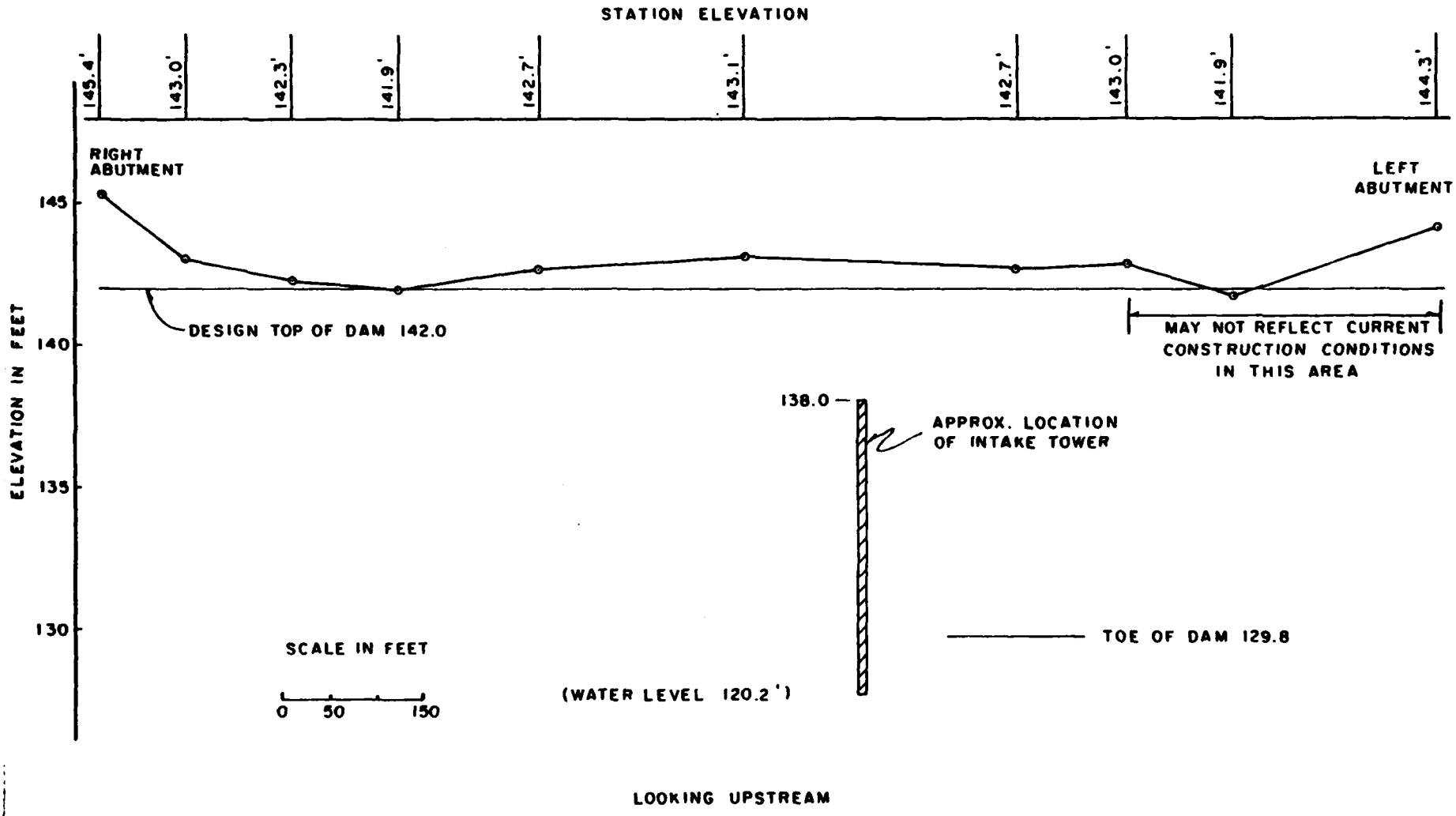
EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
UPSTREAM SLOPE	*January 1980 about sixty 8 to 10 foot high trees were planted. These should be removed and the slope restored to its original condition.*	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	*Junction of embankments and abutments is in good condition. Some minor erosion has occurred around the intake tower.*	
ANY NOTICEABLE SEEPAGE	*None observed.*	
STAFF GAGE AND RECORDER	*None*	
DRAINS	*None located.*	



FIELD OBSERVATION PLAN
OXFORD VALLEY MALL DAM

SHEET 5A OF 11



FIELD OBSERVATION PROFILE
OXFORD VALLEY MALL DAM

SHEET 5B OF 11

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	*The outlet conduit appears to be in good condition, with some minor leakds from joints in the top and sides and leachate stalactites.*	
INTAKE STRUCTURE	*Appears in good condition. No significant spalling or cracking has occurred. The intake tower has a gated 30 inch pond drain, two orfices at normal pool level, and an open top to serve as the emergency spillway.*	
OUTLET STRUCTURE	*There is no outlet structure, the outlet conduit discharges through a transition section to a culvert under US Route 1. It was noted that the joints between the headwall and wing-walls have opened. These should be sealed.*	
OUTLET CHANNEL	*N/A*	
EMERGENCY GATE	*A sluice gate on the inside of the tower controlling the 30 inch pond drain was found to seal completely.*	

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	*N/A*	
APPROACH CHANNEL	*N/A*	
DISCHARGE CHANNEL	*N/A*	
BRIDGE AND PIERS	*N/A*	

GATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	*N/A*	
APPROACH CHANNEL	*N/A*	
DISCHARGE CHANNEL	*N/A*	
BRIDGE AND PIERS	*N/A*	
GATES AND OPERATION EQUIPMENT	*N/A*	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
INSTRUMENTATION/SURVEYS	*None*	
OBSERVATION WELLS	*None*	
WEIRS	*None*	
PIEZOMETERS	*None*	
OTHER	*None*	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	*The side slopes are moderate to steep. Although well vegetated, the soils are not erosion resistant and some gullying has occurred at the upper end of the reservoir. During construction on the left side of the reservoir, care has been taken to prevent sediment from entering the reservoir and the slope has recently been seeded.*	
SEDIMENTATION	*Some sediment is accumulating at the upper end of the reservoir, apparently from the gullying, see Photograph No. 12. Sediment has negligible effect on flood water storage.*	
SIZE	*The size of the reservoir at normal pool level is smaller than shown on the design drawing, Plate 2, Appendix E.*	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	*The eight foot wide stream meanders through a lightly wooded, with heavy underbrush, floodplain and appears to be fairly stable.*	
SLOPES	*The side slopes are about 1.5H:1V. The valley gradient is about 0.01.*	
APPROXIMATE NO. OF HOMES AND POPULATION	*Lincoln Plaza, a shopping mall is immediately downstream of the dam. The outlet conduit is under the mall.*	

APPENDIX

B

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION
PHASE I

NAME OF DAM *Oxford Valley Mall Dam*

ID # *PA 00801*

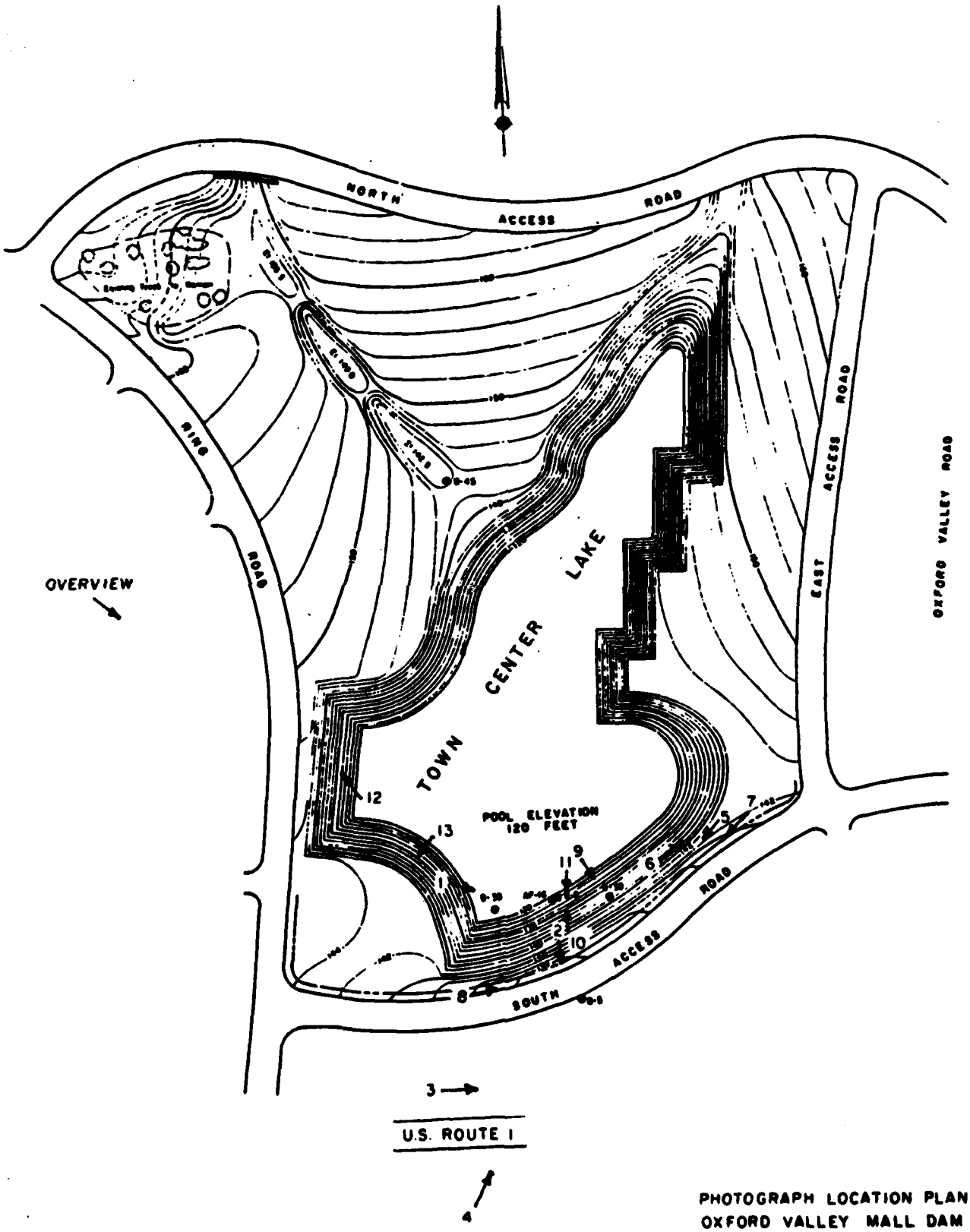
ITEM	REMARKS
AS-BUILT DRAWINGS	*Design drawings prepared by Pickering, Corts and Summerson, Inc., Newtown, Pennsylvania., were available in DER and the Owner's file.*
REGIONAL VICINITY MAP	*See Plate 1, Appendix E.*
CONSTRUCTION HISTORY	*See Section 1 of the text.*
TYPICAL SECTIONS OF DAM	*See Appendix E.*
OUTLETS - PLAN	*See Appendix E.*
DETAILS	
CONSTRAINTS	
DISCHARGE RATINGS	*See Appendix D*
RAINFALL/RESERVOIR RECORDS	*Records are not maintained in this watershed.*

ITEM	REMARKS
DESIGN REPORTS	*All reports reviewed were in DER files.*
GEOLOGY REPORTS	*See Appendix F.*
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	*Hydrology study, hydraulic design, no original flood routing; stability analysis, see text for details. No seepage analysis. Pickering, Corts and Summerson, Inc., prepared these reports.*
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	*See Plate 2, Appendix E for boring records. Site Engineers performed laboratory and field testing.*
POST-CONSTRUCTION SURVEYS OF DAM	*Survey performed during visual inspection, October, 1979*
BORROW SOURCES	

ITEM	REMARKS
MONITORING SYSTEMS	*None installed.*
MODIFICATIONS	*New construction (1979) on left abutment does not effect stability of structure but may affect overtopping potential, see text.*
HIGH POOL RECORDS	*None*
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	*None known.*
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	*None*
MAINTENANCE OPERATION RECORDS	*None*

ITEM	REMARKS
SPILLWAY PLAN SECTIONS DETAILS	*See Appendix E.*
OPERATING EQUIPMENT PLANS & DETAILS	*Notes on Plans, Appendix E.*
MISCELLANEOUS	*Prepared by Pickering, Corts and Summerson, Inc.:* 1. *Hydrology Study-18 computer printout sheets.* 2. *Hydraulic Design.* 3. *Hydraulic Design-Revised.* 4. *Soils Study.* *Prepared by DER* 5. *"Report Upon the Application of Bucks Associates", October 4, 1972.* 6. *Construction Inspection Reports.* 7. *49 black and white or color construction photographs taken by DER Inspectors.* *Also available were:* 8. *Progress reports submitted by Meridian Engineers, Inc.* 9. *Correspondence located in DER files.*

APPENDIX
C



PHOTOGRAPH LOCATION PLAN
OXFORD VALLEY MALL DAM

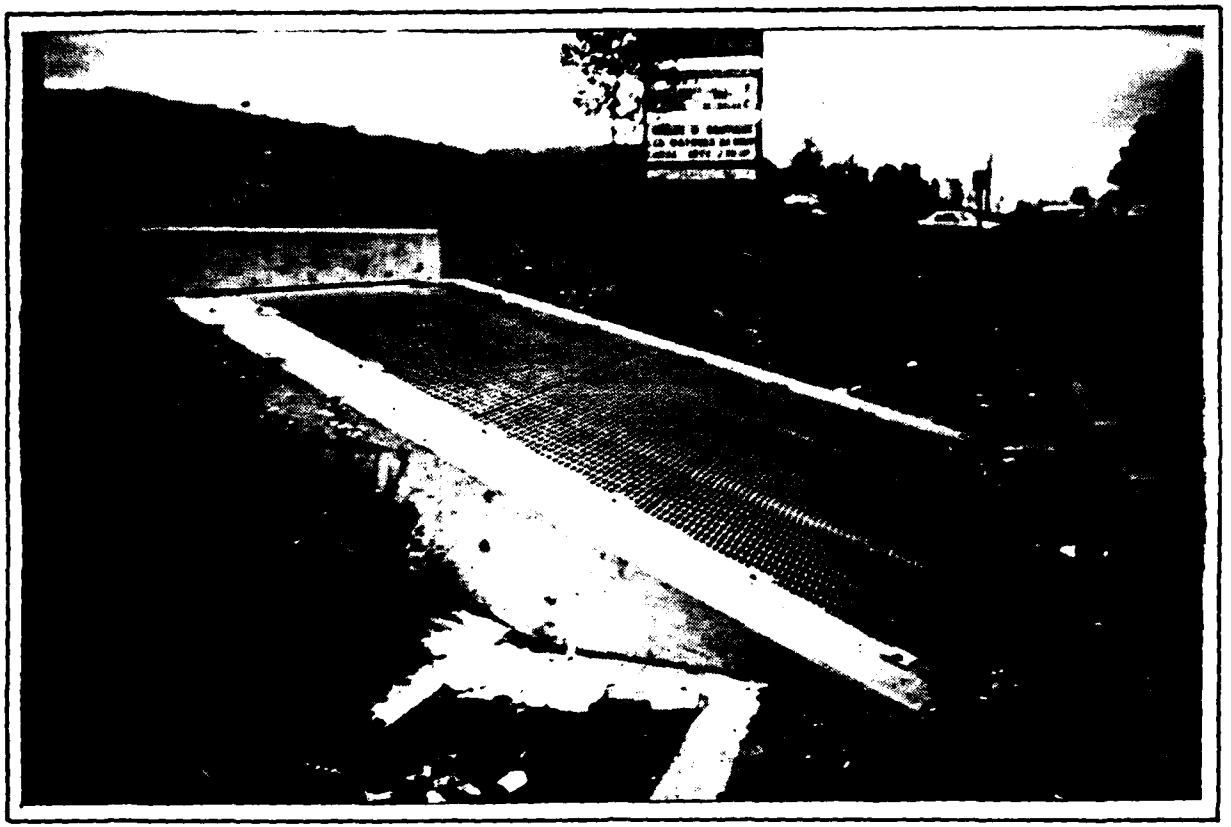
PLATE C-1

INTAKE TOWER, FLOW ENTERS THROUGH ORFICES AT NORMAL POOL ELEVATION. EXTREME FLOOD FLOWS ENTER OVER TOP OF TOWER.

PHOTOGRAPH NO. 1

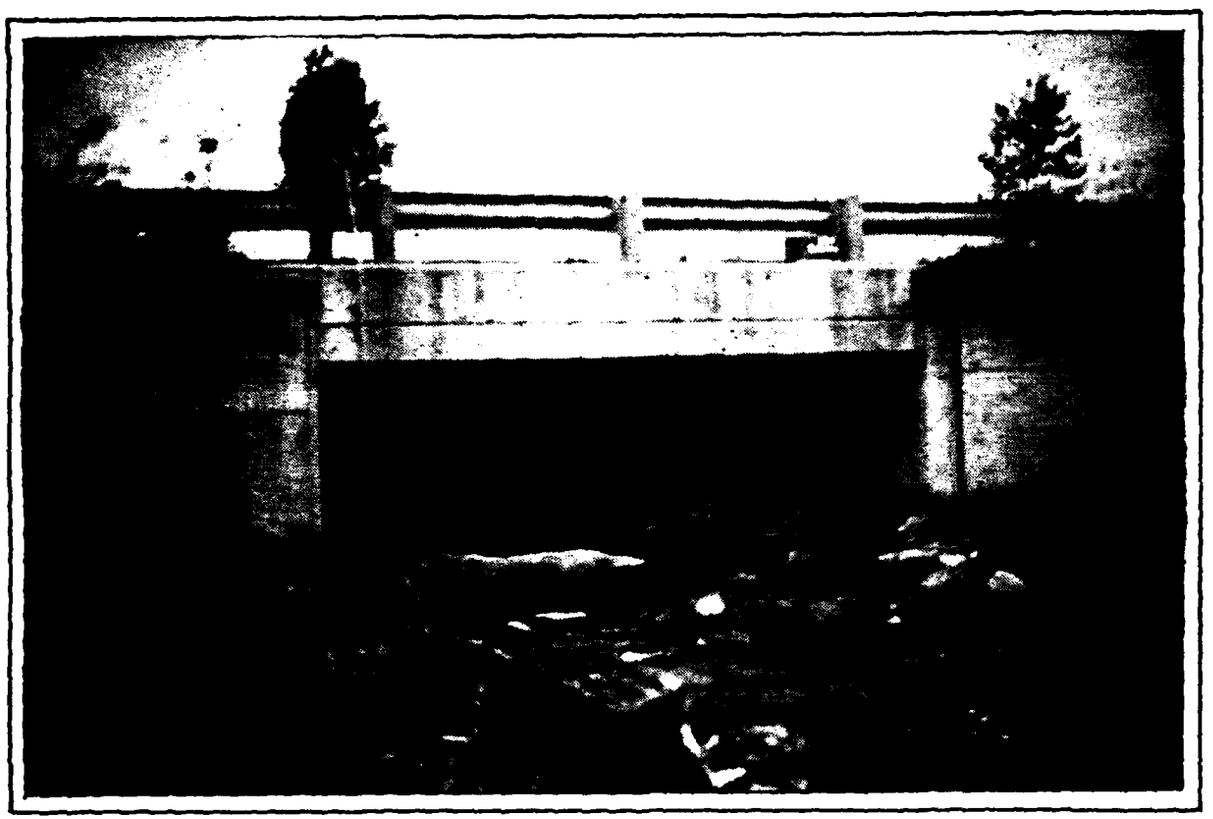
DISCHARGE CONDUIT IS UNDER THESE STORES.

PHOTOGRAPH NO. 2



TRANSITION SECTION BETWEEN DISCHARGE
CONDUIT AND CULVERT UNDER U.S. ROUTE 1.

PHOTOGRAPH NO. 3



DOWNSTREAM SIDE OF CULVERT UNDER
U.S. ROUTE 1.

PHOTOGRAPH NO. 4

CREST LOOKING FROM LEFT ABUTMENT.

PHOTOGRAPH NO. 5

LEFT ABUTMENT, EXCAVATION IS ABOUT
FIVE FEET LOWER THAN CREST.

PHOTOGRAPH NO. 6

PARKING LOT CONSTRUCTED AT LEFT ABUTMENT.

PHOTOGRAPH NO. 7

DOWNSTREAM TOE OF EMBANKMENT.

PHOTOGRAPH NO. 8

EROSION TO RIGHT OF INTAKE TOWER.

PHOTOGRAPH NO. 9

INTAKE TOWER FORMS APPARENTLY
DEFLECTED DURING CONSTRUCTION.

PHOTOGRAPH NO. 10

DAMAGE TO SLOPE NEAR WATER LINE, PROBABLY CAUSED BY FOOT TRAFFIC.

PHOTOGRAPH NO. 11

STORM SEWER OUTLET INTO THE RESERVOIR. THE PIPE IS 66 INCHES BY 72 INCHES.

PHOTOGRAPH NO. 12

SMALL ANIMAL HOLE IN RESERVOIR SLOPE.

PHOTOGRAPH NO. 13

APPENDIX

D

OXFORD VALLEY MALL DAM
CHECK LIST
HYDROLOGIC AND HYDRAULIC
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: *About 30% developed with mall, little other development.*

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): *120 feet (34± acre feet)*

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): *141.9 feet (308± acre-feet)*

ELEVATION MAXIMUM DESIGN POOL: *142 feet design top of dam.*

ELEVATION TOP DAM: *141.9 feet.*

SPILLWAY

a. Elevation *N/A*

b. Type *N/A*

c. Width *N/A*

d. Length *N/A*

e. Location Spillover *N/A*

f. Number and Type of Gates *N/A*

OUTLET WORKS:

a. Type *Reinforced concrete two stage octagonal drop inlet and 8 ft.x 8 ft. discharge conduit.*

b. Location *Tower at upstream toe.*

c. Entrance inverts *Orfices, 120 feet; top, 138 feet.*

d. Exit inverts *104.22 feet (850 feet downstream).*

e. Emergency draindown facilities *30-inch pond drain at 115 feet.*

HYDROMETEOROLOGICAL GAGES:

a. Type *None.*

b. Location *N/A*

c. Records *N/A*

MAXIMUM NON-DAMAGING DISCHARGE: *Not determined.*

OXFORD VALLEY MALL DAM
HYDROLOGIC AND HYDRAULIC
BASE DATA

DRAINAGE AREA:(1) *0.97 mile*

PROBABLE MAXIMUM PRECIPITATION (PMP)
FOR 10 SQ. MILES IN 24 HOURS:(2) *23.5 inches*

ADJUSTMENT FACTORS FOR DRAINAGE AREA (%):(3)

Zone *6*

6 Hours *113 percent.*

12 Hours *123 percent.*

24 Hours *132 percent.*

48 Hours *142 percent.*

SNYDER HYDROGRAPH PARAMETERS:(4)

Zone *5*

C_p, C_t *0.81, 1.50*

L(5) *1.54*

Lca (6) *0.43*

$tp=C_t\ (L \cdot Lca)^{0.3}$ *1.33*

SPILLWAY CAPACITY AT MAXIMUM
WATER LEVEL(7) *1558 cfs*

---

(1) Measured from USGS maps.
(2) Hydrometerological Report No. 33, Figure 1.
(3) Hydrometerological Report No. 33, Figure 2.
(4) Information received from Corps of Engineers, Baltimore District.
(5) Length of longest water course from outlet to basin divide, measured from USGS maps.
(6) Length of water course from outlet to point opposite the centroid of drainage area, (see Plate 1, Appendix E) measured from USGS maps.
(7) See Sheet *5,11* of this Appendix.

HEC-1, REVISED
FLOOD HYDROGRAPH PACKAGE

The original "Flood Hydrograph Package" (HEC-1), developed by the Hydrologic Engineering Center, Corps of Engineers, has been modified for use under the National Dam Inspection Program. The "Flood Hydrograph Package (HEC-1), Dam Safety Version", hereinafter referred to as, HEC-1, Rev., has been modified to require less detailed input and to include a dam breach analysis. The required input is obtained from the field inspection of a dam, any available design/evaluation data, relatively simple hydraulic calculations, or information from the USGS Quandrangle maps. The input format is flexible in order to reflect any unique characteristics of an individual dam.

HEC-1, Rev. computes a reservoir inflow hydrograph based on individual watershed characteristics such as: area, percentage of impervious surface area, watershed shape, and hydrograph characteristics determined from regional correlation studies by the Corps of Engineers, Baltimore District. The inflow is routed through the reservoir using spillway discharge data obtained from the field inspection or design data. Flood storage capacity is determined from USGS maps or design information and verified by the field inspection. In the event a spillway cannot discharge 0.5 PMF without overtopping and failure of the dam, downstream channel characteristics obtained from the field inspection and USGS maps are inputed and flows are routed downstream to the damage center and a dam breach analysis is performed.

Included in this Appendix are the HEC-1, Rev. pertinent input values and a summary print-out tables.

Classification (Ref - Recommended Guidelines for Safety Inspection of Dams)

1. The hazard potential is rated as "High" as there would be loss of life if the dam failed.

2. The size classification is "Small" based on its 27 ft. height and 308 acre-feet total storage capacity

3. The selected spillway flood, based on size and hazard classification is 0.5 PMF (Probable Maximum Flood).

Hydrology and Hydraulic Analysis

1. Original data -
   - the spillway was designed to discharge the Department of Forests and Waters "C" curve value (of 1540cfs) when water is at the design top of dam. The pond was sized to store runoff from the 100yr-24hr. storm without discharging over the top of the tower.
   - hydraulic design did not include flood routing

2. Evaluation of data -
   - inflow hydrographs for the 100yr and PMP floods are included in this appendix. Because the maximum rainfall intensity of the original hydrographs is greater than the established standards for Phase I Inspections, the spillway adequacy of this dam is evaluated by the use of the HEC-1, Rev., computer program.
   - inflow hydrograph parameters are shown on sheet 2
   - elevation - storage
     surface areas were estimated from the construction drawings with allowances made for the different reservoir configuration. (Capacity shown on sheet 8)

elevation	area
115	6 acres estimated
120	7.7 acres
130	12.5 acres
142	16.9 acres
146	19 acres estimated

- elevation - discharge, design calculations reviewed and judged adequate

discharge through orfices

$Q = 0.6 A \sqrt{2gH}$

A (area) = 2 (9" x 1'2") = 2.375 ft² ✓

H (head) measured from water surface to orfice centerline

$Q = 11.44 \sqrt{H}$

discharge over top

$Q = C L H^{3/2}$

C = 3.1 design value

L = 64 ft, length of weir

H measured from water surface to weir crest

$Q = 198 H^{3/2}$ ✓

discharge through conduit

$Q = \frac{A}{\sqrt{2 + K_e L_c}} \sqrt{2gh}$

A (area) = 8 x 8 = 64 ft² ✓

K_e (friction loss in conduit) = 0.00167 for n = 0.012 (design values)

L_c (length of conduit) = 851 ft as constructed instead of 800 ft used in design

H measured from water surface to centerline of conduit outlet (105.31)

$Q = 272.7 H^{1/2}$ ✓

discharge data shown on sheet 8.

- Spillway Adequacy - as spillway will not pass the 0.5 PMF without overtopping, the spillway is considered "Inadequate".

the embankment is considered to be in good condition judged capable of withstanding overtopping of less than one foot for about one hour. Plan 2 (sheet 9) considers failure of the dam. As the dam is considered not to fail during the 0.5 PMF, the spillway is not considered "Seriously Inadequate."

1**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

OXFORD VALLEY MALL DAM
NDI PA 00801 DER NO. 9-171
OVERTOPPING ANALYSIS

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
150	0	15	0	0	0	0	0	-4	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 2 NRTIO= 3 LRTIO= 1
RTIOS= .45 .50 1.00

Sheet 6 of 13

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
IN	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	1	.97	0.00	.97	0.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	23.50	113.00	123.00	132.00	142.00	0.00	0.00

TRSPC COMPUTED BY THE PROGRAM IS .800

LOSS DATA

LKOPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	.20

UNIT HYDROGRAPH DATA

TP= 1.33 CP= .81 NTA= 0

RECESSION DATA

STRTQ= -1.50 QRCSN= -.05 RTIOR= 2.00

UNIT HYDROGRAPH 16 END-OF-PERIOD ORDINATES, LAG= 1.33 HOURS, CP= .80 VOL= 1.00

33. 114. 209. 299. 362. 379. 352. 277. 182. 113.
70. 43. 27. 17. 10. 6.

END-OF-PERIOD FLOW

0

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
									SUM	26.70	24.78	1.92	61764.
										(678.)	(629.)	(49.)	(1748.96)

Sheet 7 of 13

HYDROGRAPH ROUTING

OUTFLOW HYDROGRAPH

	ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
	OUT	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-120.	-1

STAGE	120.00	120.75	126.00	138.00	139.00	140.00	141.00	142.00	143.00	145.00
FLOW	0.00	6.40	27.00	48.00	247.00	611.00	1083.00	1611.00	1635.00	1682.00
SURFACE AREA=	6.	8.	13.	17.	19.					
CAPACITY=	0.	34.	134.	310.	382.					
ELEVATION=	115.	120.	130.	142.	146.					

CREL	SPWID	COQW	EXPW	ELEVL	COQL	CAREA	EXPL
120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COQD	EXPD	DAMWID
141.9	0.0	0.0	0.

CREST LENGTH	0.	325.	1250.
AT OR BELOW ELEVATION	141.9	142.6	143.1

Sheet 8 of 13

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
40.	1.00	130.00	1.00	120.00	145.00

- SET HIGH TO PREVENT FAILURE

PEAK OUTFLOW IS 1496. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 1657. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 3738. AT TIME 41.00 HOURS

FAILEL - water surface elevation at which dam failure is assumed to start

DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
40.	1.00	130.00	1.00	120.00	143.10

PEAK OUTFLOW IS 1496. AT TIME 41.50 HOURS

PEAK OUTFLOW IS 1657. AT TIME 41.50 HOURS

BEGIN DAM FAILURE AT 40.25 HOURS

PEAK OUTFLOW IS 5046. AT TIME 41.25 HOURS

Sheet 9 of 13

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .45	RATIO 2 .50	RATIO 3 1.00
HYDROGRAPH AT	IN	.97	1	1682.	1869.	3738.
	(	2.51)	(	47.63)(	52.92)(	105.85)(
			2	1682.	1869.	3738.
			(	47.63)(	52.92)(	105.85)(
ROUTED TO	OUT	.97	1	1496.	1657.	3738.
	(	2.51)	(	42.37)(	46.93)(	105.86)(
			2	1496.	1657.	5046.
			(	42.37)(	46.93)(	142.90)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 No failure...

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	120.00	120.00	141.90
STORAGE	34.	34.	308.
OUTFLOW	0.	0.	1558.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.45	141.78	0.00	306.	1496.	0.00	41.50	0.00
.50	142.26	.36	314.	1657.	1.00	41.50	0.00
1.00	143.33	1.43	333.	3738.	3.50	41.00	0.00

PLAN 2 Failure.....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	120.00	120.00	141.90
STORAGE	34.	34.	308.
OUTFLOW	0.	0.	1558.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.45	141.78	0.00	306.	1496.	0.00	41.50	0.00
.50	142.26	.36	314.	1657.	1.00	41.50	0.00
1.00	143.13	1.23	329.	5046.	1.42	41.25	40.25

LOCATION - BUCK COUNTY, PA. GOLDEN ANGE CREEK 400' NORTH OF U.S. 1

ZONE 6
ANTECEDENT MOISTURE CONDITION II
DRAINAGE AREA 1.10 SQ. MI.
TYPE OF STORM - 100 YEAR FREQUENCY

6 HOUR,10 SQ. MI. PRECIPITATION 5.23 INCHES

TIME (HOURS)	0 - 6	6 - 12	12 - 24	24 - 48
PERCENT ADJUSTMENT	100.5	109.0	117.5	126.2

LENGTH OF LONGEST WATER COURSE 1.81 MILES
HEADWATER ELEVATION 180.0 FEET
SITE ELEVATION 110.0 FEET
ELEVATION DIFFERENCE = 70.0 FEET
TIME OF CONCENTRATION = 1.0 HOURS

SUB AREA SQ. MI.	USAGE	CURVE NO.
1.07	HEAVILY PAVED	90
0.03	RESIDENTIAL	55

HYDROLOGIC SOIL COVER COMPLEX NUMBER = 89.0

DURATION (HOURS)	TIME TO PEAK (HOURS)	BASE TIME (HOURS)	PEAK DISCHARGE FOR 1 IN. (SEC.-FT)	INCREMENTAL RAIN (INCHES)	ACCUMULATIVE RAIN (INCHES)	ACCUMULATIVE RUNOFF (INCHES)	INCREMENTAL RUNOFF (INCHES)	INCREMENTAL LOSS (INCHES)	DISCHARGE FOR INCRE RUNOFF (SEC.-FT)	BEGIN TIME (HOURS)	PEAK TIME (HOURS)	END TIME (HOURS)
0.0 - 0.5	0.85	2.27	625.0	0.21	0.21	0.00	0.00	0.21	0.0	0.00	0.85	2.27
0.5 - 1.0	0.85	2.27	625.0	0.21	0.42	0.02	0.02	0.19	13.5	0.50	1.35	2.77
1.0 - 1.5	0.85	2.27	625.0	0.21	0.63	0.09	0.07	0.14	43.7	1.00	1.85	3.27
1.5 - 2.0	0.85	2.27	625.0	0.21	0.84	0.19	0.10	0.11	63.9	1.50	2.35	3.77
2.0 - 2.5	0.85	2.27	625.0	0.26	1.10	0.35	0.16	0.10	99.0	2.00	2.85	4.27
2.5 - 3.0	0.85	2.27	625.0	0.37	1.47	0.61	0.26	0.11	162.1	2.50	3.35	4.77
3.0 - 3.5	0.85	2.27	625.0	1.89	3.36	2.24	1.62	0.27	1015.0	3.00	3.85	5.27
3.5 - 4.0	0.85	2.27	625.0	0.68	4.05	2.87	0.64	0.05	397.5	3.50	4.35	5.77
4.0 - 4.5	0.85	2.27	625.0	0.42	4.47	3.27	0.40	0.03	247.2	4.00	4.85	6.27
4.5 - 5.0	0.85	2.27	625.0	0.37	4.84	3.61	0.34	0.03	214.3	4.50	5.35	6.77
5.0 - 5.5	0.85	2.27	625.0	0.21	5.05	3.80	0.19	0.03	115.8	5.00	5.85	7.27
5.5 - 6.0	0.85	2.27	625.0	0.21	5.26	3.98	0.19	0.03	115.8	5.50	6.35	7.77
6.0 - 12.0	3.60	9.60	147.8	0.44	5.70	4.13	0.14	0.30	21.4	6.00	9.60	15.60
12.0 - 24.0	6.60	17.60	80.6	0.44	6.15	4.13	0.00	0.44	0.0	12.00	18.60	29.60
24.0 - 48.0	12.60	33.60	42.2	0.46	6.60	4.13	0.00	0.46	0.0	24.00	36.60	57.60

TIME (HOURS)	TOTAL HYDROGRAPH ORDINATE (SEC-FT)
0.00	0.
0.50	0.
1.00	8.
1.50	38.
2.00	84.
2.50	142.
3.00	227.
3.50	807.
4.00	1249.
4.50	1084.
5.00	757.
5.50	470.
6.00	335.
12.00	13.
24.00	0.
0.85	6.
1.35	32.
1.85	79.
2.35	137.
2.85	220.
3.35	664.
3.85	1313.
4.35	1205.
4.85	893.
5.35	940.
5.85	376.
6.35	256.
9.60	21.
18.60	0.
36.60	0.
2.27	125.
2.77	202.
3.27	563.
3.77	1195.
4.27	1211.
4.77	930.
5.27	545.
5.77	380.
6.27	264.
6.77	127.
7.27	46.
7.77	11.
15.60	0.
29.60	0.
57.60	0.

Sheet 12 of 13

JOB NUMBER HY-7920
LOCATION - BUCKS COUNTY, PA. QUEEN ANNE CREEK - TOWN CENTER DAM

ZONE 6 ✓
ANTECEDENT MOISTURE CONDITION II ✓
DRAINAGE AREA 1.10 SQ. MI. 0.97 from USGS maps
TYPE OF STORM - M.P.P. ✓ Total Storage V = (1.10)(29.20)(53.33) = 1713 Acre ft

23.5 + 1.13 = 26.52 inches

6 HOUR, 10 SQ. MI. PRECIPITATION 26.00 INCHES

TIME (HOURS)	0 - 6	6 - 12	12 - 24	24 - 48
PERCENT ADJUSTMENT	100.5	109.0	117.5	126.2

Hydrology Study in DER Files

LENGTH OF LONGEST WATER COURSE 1.81 MILES 1.54 from USGS
HEADWATER ELEVATION 180.0 FEET 200 ft. max. elev. in watershed
SITE ELEVATION 110.0 FEET 120 ft normal pool elev.
ELEVATION DIFFERENCE = 70.0 FEET ~ 80 ft.
TIME OF CONCENTRATION = 1.0 HOURS
↳ computed? estimated?

SUB AREA SQ. MI.	USAGE	CURVE NO.
1.07	HEAVILY PAVED	90 low
0.03	RESIDENTIAL	55 low

future conditions ?

HYDROLOGIC SOIL COVER COMPLEX NUMBER = 89.0 adequate for existing conditions

DURATION (HOURS)	TIME TO PEAK (HOURS)	BASE TIME (HOURS)	PEAK DISCHARGE FOR 1 IN. (SEC.-FT)	INCREMENTAL RAIN (INCHES)	ACCUMULATIVE RAIN (INCHES)	ACCUMULATIVE RUNOFF (INCHES)	INCREMENTAL RUNOFF (INCHES)	INCREMENTAL LOSS (INCHES)	DISCHARGE FOR INCRE RUNOFF (SEC.-FT)	BEGIN TIME (HOURS)	PEAK TIME (HOURS)	END TIME (HOURS)
0.0 - 0.5	0.85	2.27	625.0	1.05	1.05	0.31	0.31	0.73	196.7	0.00	0.85	2.27
0.5 - 1.0	0.85	2.27	625.0	1.05	2.09	1.11	0.79	0.25	494.8	0.50	1.35	2.77
1.0 - 1.5	0.85	2.27	625.0	1.05	3.14	2.03	0.92	0.12	575.2	1.00	1.85	3.27
1.5 - 2.0	0.85	2.27	625.0	1.05	4.18	3.00	0.97	0.07	606.8	1.50	2.35	3.77
2.0 - 2.5	0.85	2.27	625.0	1.31	5.49	4.24	1.25	0.06	779.6	2.00	2.85	4.27
2.5 - 3.0	0.85	2.27	625.0	1.83	7.32	6.02	1.78	0.05	1111.0	2.50	3.35	4.77
3.0 - 3.5	0.85	2.27	625.0	9.41	16.72	15.33	9.31	0.10	5818.6	3.00	3.85	5.27
3.5 - 4.0	0.85	2.27	625.0	3.40	20.12	18.70	3.37	0.03	2107.4	3.50	4.35	5.77
4.0 - 4.5	0.85	2.27	625.0	2.09	22.21	20.77	2.07	0.03	1290.9	4.00	4.85	6.27
4.5 - 5.0	0.85	2.27	625.0	1.83	24.04	22.57	1.80	0.03	1127.5	4.50	5.35	6.77
5.0 - 5.5	0.85	2.27	625.0	1.05	25.08	23.59	1.02	0.03	637.6	5.00	5.85	7.27
5.5 - 6.0	0.85	2.27	625.0	1.05	26.13	24.61	1.02	0.03	637.6	5.50	6.35	7.77
6.0 - 12.0	3.60	9.60	147.8	2.21	28.34	26.52	1.91	0.30	282.3	6.00	9.60	15.60
12.0 - 24.0	6.60	17.60	80.6	2.21	30.55	28.13	1.61	0.60	129.8	12.00	18.60	29.60
[illegible]	12.60	33.60	42.2	2.26	32.81	29.20	1.06	1.20	44.9	24.00	36.60	57.6

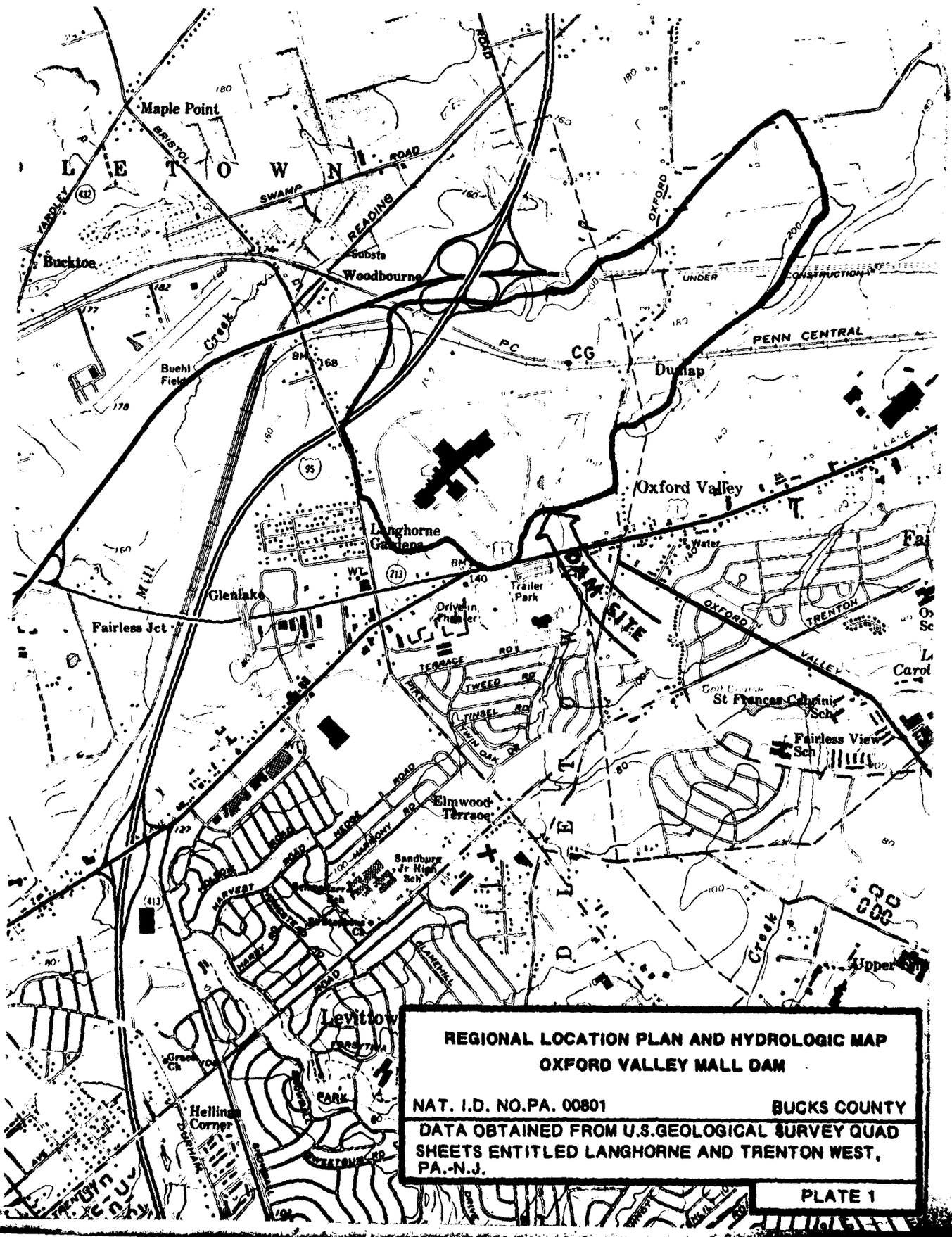
M.P.P. 6hr 89 ✓

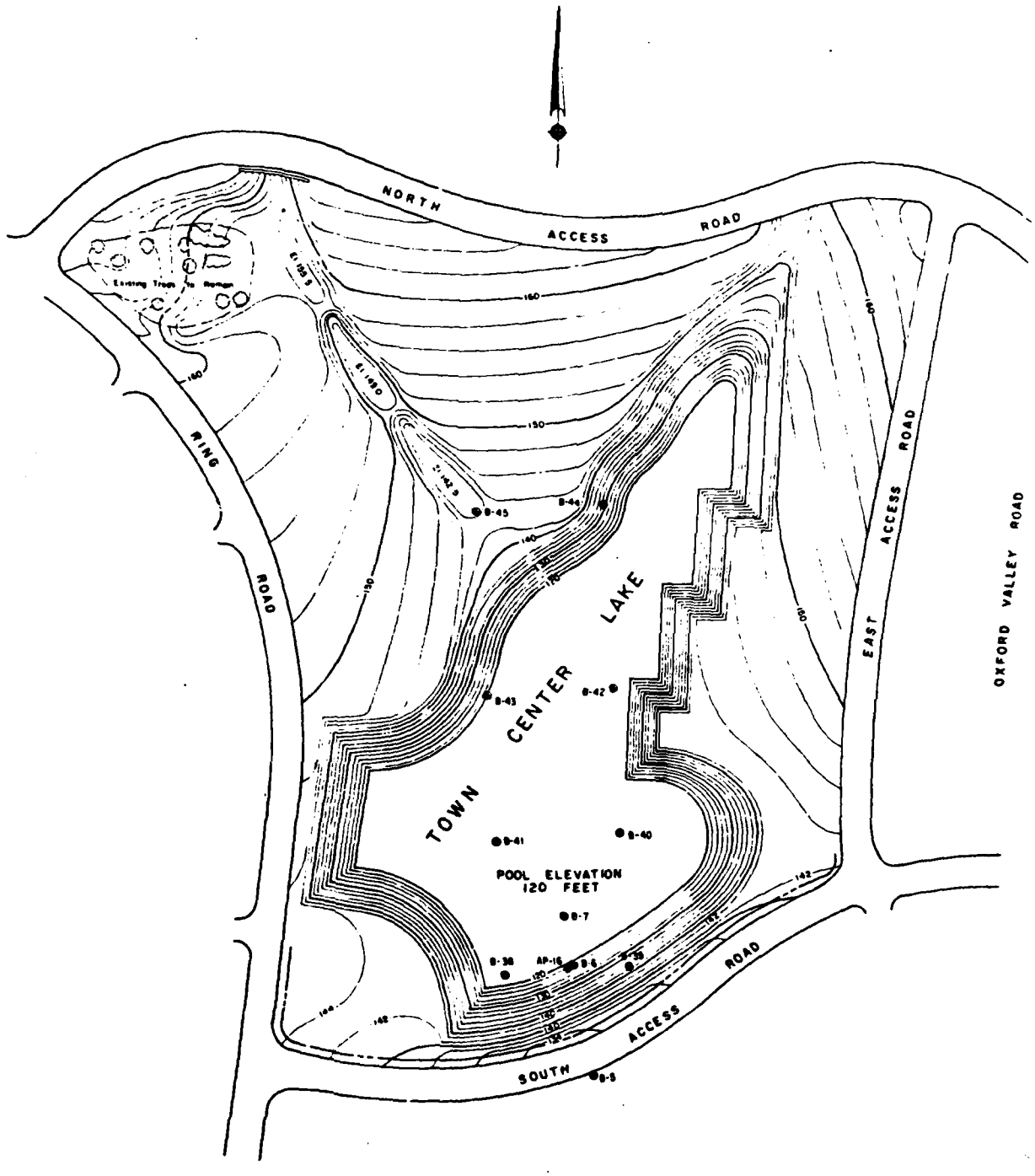
Maximum 1 hour precipitation (9.41 + 3.40) is 49% of the 6 hr precipitation, which is greater than the maximum 1 hour precipitation (38%) established as minimum criteria for Phase I investigations.

TIME (HOURS)	TOTAL HYDROGRAPH ORDINATE (SEC-FT)
0.00	0.
0.50	115.
1.00	467.
1.50	888.
2.00	1178.
2.50	1408.
3.00	1790.
3.50	4950.
4.00	7201.
4.50	6020.
5.00	4076.
5.50	2489.
6.00	1805.
12.00	170.
24.00	66.
0.85	401.
1.35	860.
1.85	1205.
2.35	1448.
2.85	1802.
3.35	4199.
3.85	7639.
4.35	6738.
4.85	4842.
5.35	2850.
5.85	2013.
6.35	1412.
9.60	282.
18.60	130.
36.60	45.
2.27	1378.
2.77	1690.
3.27	3624.
3.77	7000.
4.27	6810.
4.77	5062.
5.27	2876.
5.77	2030.
6.27	1445.
6.77	734.
7.27	324.
7.77	139.
15.60	71.
29.60	20.
57.60	0.

APPENDIX

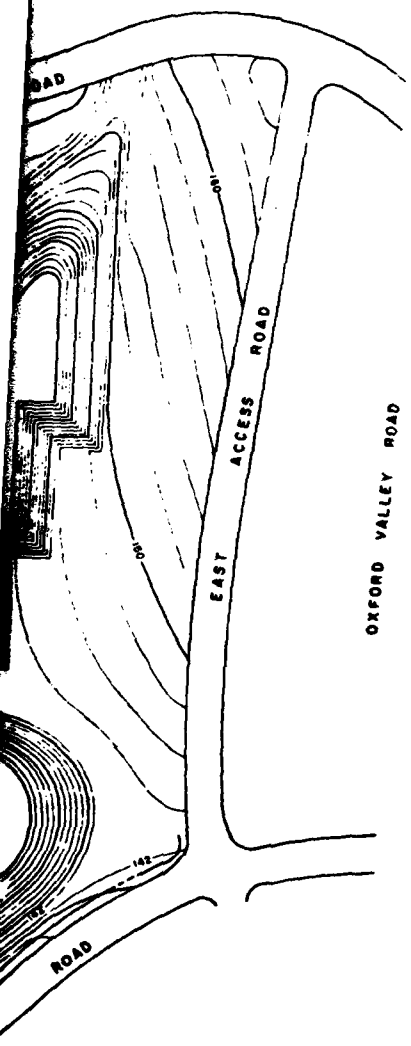
E


Maple Point
L E T O W N
BRISTOL ROAD
SWAMP
READING
OXFORD
Bucktoe
Substa
Woodbourne
UNDER CONSTRUCTION
PENN CENTRAL
PC
CG
Dunlap
Buehl Field
Creek
BM 268
Oxford Valley
Langhorne Gardens
Water
Glenlake
Trailer Park
Drive-in Theater
Fairless Jct
DAM SITE
OXFORD VALLEY
TRENTON
TERRACE RD
TWEED RD
TINSEL RD
TWIN OAK DR
St Frances Cabrini Sch
Fairless View Sch
Elmwood Terrace
Sandburg Jr High Sch
HARVEST ROAD
HENRY RD
HAMEVILL
Levittown
PARK
Hellings Corner
Upper
Creek
REGIONAL LOCATION PLAN AND HYDROLOGIC MAP
OXFORD VALLEY MALL DAM
NAT. I.D. NO.PA. 00801
BUCKS COUNTY
DATA OBTAINED FROM U.S.GEOLOGICAL SURVEY QUAD SHEETS ENTITLED LANGHORNE AND TRENTON WEST, PA.-N.J.
PLATE 1



OLD LINCOLN HIGHWAY ROUTE #1

MERIDIAN ENG
PICKERING, CORTS



BORING RESULTS

El 114± B-1

0 - 7'	Brown Silty Clay with Mica Till, Water @ 20'
7 - 19'	Brown Sandy Decayed Mica Schist

El 116.5± B-2

0' - 2'	Mica Till, Water @ 2'
2' - 4'	Brown Sandy Mica with Silt
4' - 8'	Brown Sandy Silt with Rock Fragment
8' - 12'	Brown Sandy Mica
12' - 20'	Brown Decayed Mica Schist

El 114± B-3

0 - 4'	Sand, Gravel, some Clay, Boulders
4' - 19'	Brown Sandy Decayed Mica Schist, Water @ 5'

El 112± B-4

0 - 2'	Brown Silty Clay
2 - 4'	Fine to Coarse Sand & Gravel
4' - 116"	Brown Sandy Decayed Mica Schist, Water @ 5'-8"

El 114± B-5

0'-2'-6"	Gray Silt some Sand
2'-6"-8'	Brown Fine to Coarse Sand & Boulders Water @ 30'
	Refusal @ 80'

El 122± B-6

0' - 4'	Fine Brown Silty Sand
4' - 12'	Fine Brown Sandy Mica Schist Water @ 10'-3"
12' - 22'	Brown Decayed Mica Schist

El 126± B-7

0 - 3'	Asphalt Cinders Mica Till
3 - 8'	Brown Fine Silty Sand
8' - 13'6"	Brown Decayed Mica Schist Refusal @ 15'-6"
13'-26	Brown & Gray Weathered Rock Water @ 19 - 8"

El 125± AP-16

0'-6'6"	Brown Silty Fine Sand Trace Sand
6'6"-7'6"	Brown Mica Silty Fine Sand, Rock Fragments
7'6"-10'	Brown Fine Sand, Silt large Rock Fragments

El 127± B-38

0' - 2'	Dark Brown Silt Fine Sand Trace of Gravel & Mica Flakes
2' - 4'	Grayish Brown Silt Fine Sand Trace of Clay & Mica Flakes Water @ 3'
4' - 6'	Gray Brown Silty Sand Trace Mica Flakes
6' - 8'	Decomposed Mica Schist

El 127± B-39

0' - 5'	Brown Fine Silty Sand
5' - 7'6"	Brown Mica Sand Rock Fragments Trace Mica Flakes
7'6" - 9'	Green Mica Sand Mica Flakes
9' - 15'	Brown Mica Sand Mica Flakes Water @ 12'3"

El 131± B-40

0' - 3'	Brown Fine Silty Sand
3' - 9'	Brown Mica Sand Silt Rock Fragment Water @ 3' - 6'
9' - 20'	Gray Mica Sand Some Silt Mica Flakes

El 126± B-41

0' - 2'	Dark Brown Silt, Fine Sand & Rock
2' - 4'	Fine Gray Silty Sand Trace of Clay & Gravel
4' - 6'	Fine Gray Silty Sand Clay & Mica Flakes Water @ 4'6"
6' - 10'	Brown Decomposed Mica Schist

El 131± B-42

0' - 6'	Brown Silt Trace of Fine Sand Water @ 4'
6' - 10'	Fine Brown Silty Sand Rock Fragments
10' - 12'	Decomposed Mica Schist

El 128± B-43

0' - 2'	Brown Silt Trace Fine Sand & Mica Flakes
2' - 5'	Brown Silt Fine to Medium Sand Trace of Gravel & Rock Fragments Water @ 5'
5' - 8'	Fine to Coarse Brown Silty Sand & Gravel
8' - 10'	Tannish Gray Fine Silty Sand
10' - 11'9"	Brown Decomposed Mica Schist

El 135± B-44

0' - 0'6"	Topsoil
0'6" - 3'	Brown Silty Sand Trace of Fine Gravel
3' - 14'6"	Brown Mica Sand Trace of Silt Refusal @ 14'-6"

El 163± B-45

0' - 2'	Brown Silt Trace of Fine Sand
2' - 5'	Fine Brown Silty Sand Trace of Coarse Sand water @ 5'
5' - 10'	Multi-Colored Fine to Coarse Sand & Gravel Some Silt & Mica Rock Fragments
10' - 12'	Decomposed Mica Schist

NOTE

1. See Drawing No 3 of 9 for Locations of B-1 thru B-6
2. Boring Data Supplied by Meridian Engineering Inc
   - A Borings & Logs B-1 thru B-7 by Raymond International, Inc
   - B Borings & Logs AP-16 & B-36 thru B-45 by Site Engineers, Inc
3. Top of Ground Elevations Estimated from Topography

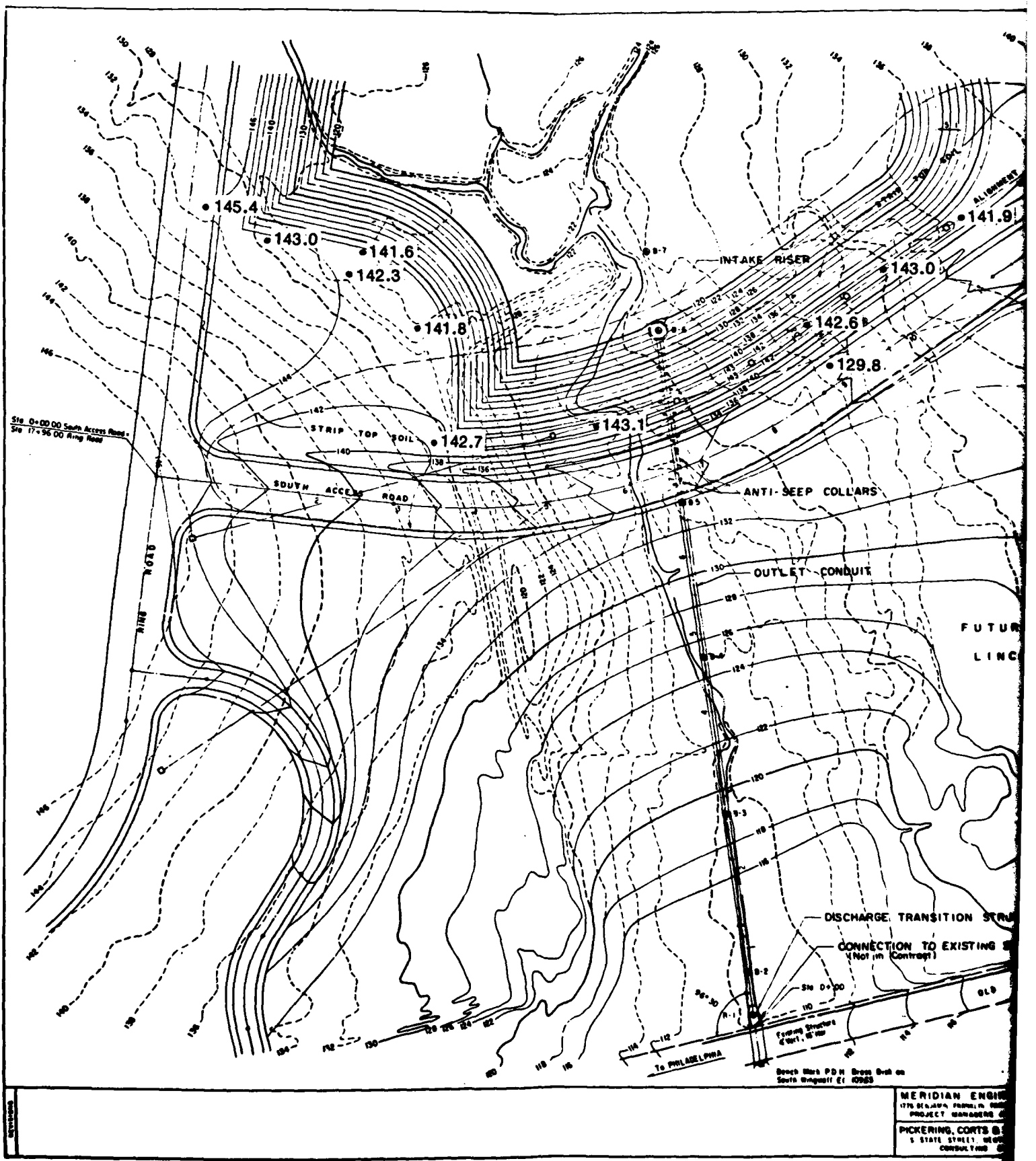
STICK FILE

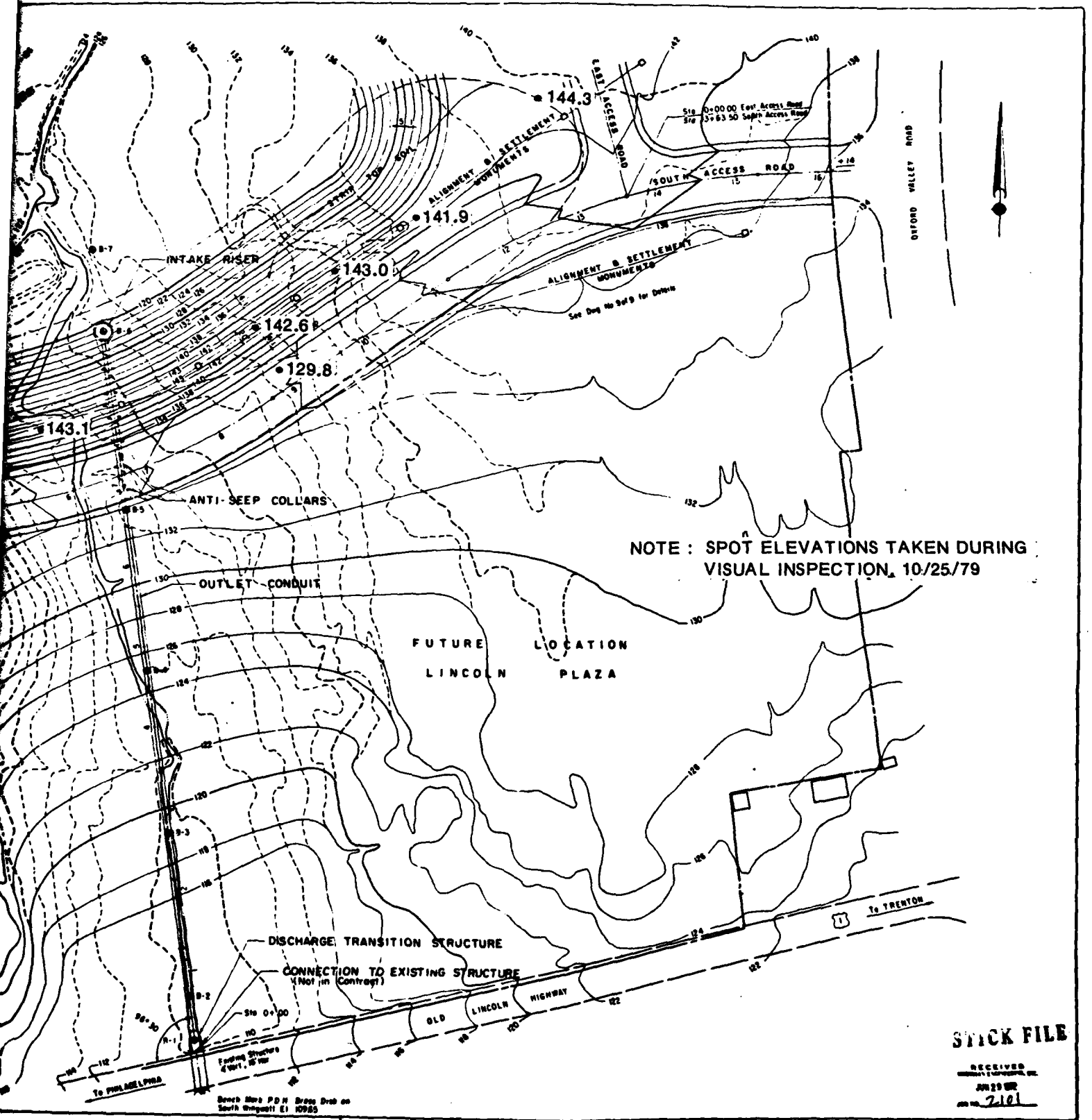
RECEIVED
APR 29
2101

MERIDIAN ENGINEERING INC. 1776 BENJAMIN FRANKLIN PARKWAY, PHILADELPHIA, PA PROJECT MANAGERS AND ENGINEERS	TOWN CENTER DAM MIDDLETOWN TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA	GENERAL PLAN WITH TEST BORINGS	DATE JUNE, 1972
PICKERING, CORTS & SUMMERSON, INC 5 STATE STREET, NEWTOWN, PENNSYLVANIA CONSULTING ENGINEERS	THE M A KRAVITZ COMPANY INC 160 N GULF ROAD, KING OF PRUSSIA, PENNSYLVANIA PROJECT DEVELOPERS		SCALE 1" = 100'
			JOB NO MV-0630
			DRAWN CG
			CHK'D JD
			APPD ABS

SHEET 2 of 9

PLATE 2


145.4
143.0
141.6
142.3
141.8
141.9
143.0
142.6
129.8
143.1
142.7
INTAKE RISER
ANTI-SEEP COLLARS
OUTLET CONDUIT
STRIP TOP SOIL
SOUTH ACCESS ROAD
DISCHARGE TRANSITION STR
CONNECTION TO EXISTING
(Not in Contract)
To PHILADELPHIA
MERIDIAN ENGI
PICKERING, CORTS &
PROJECT MANAGERS
CONSULTANTS

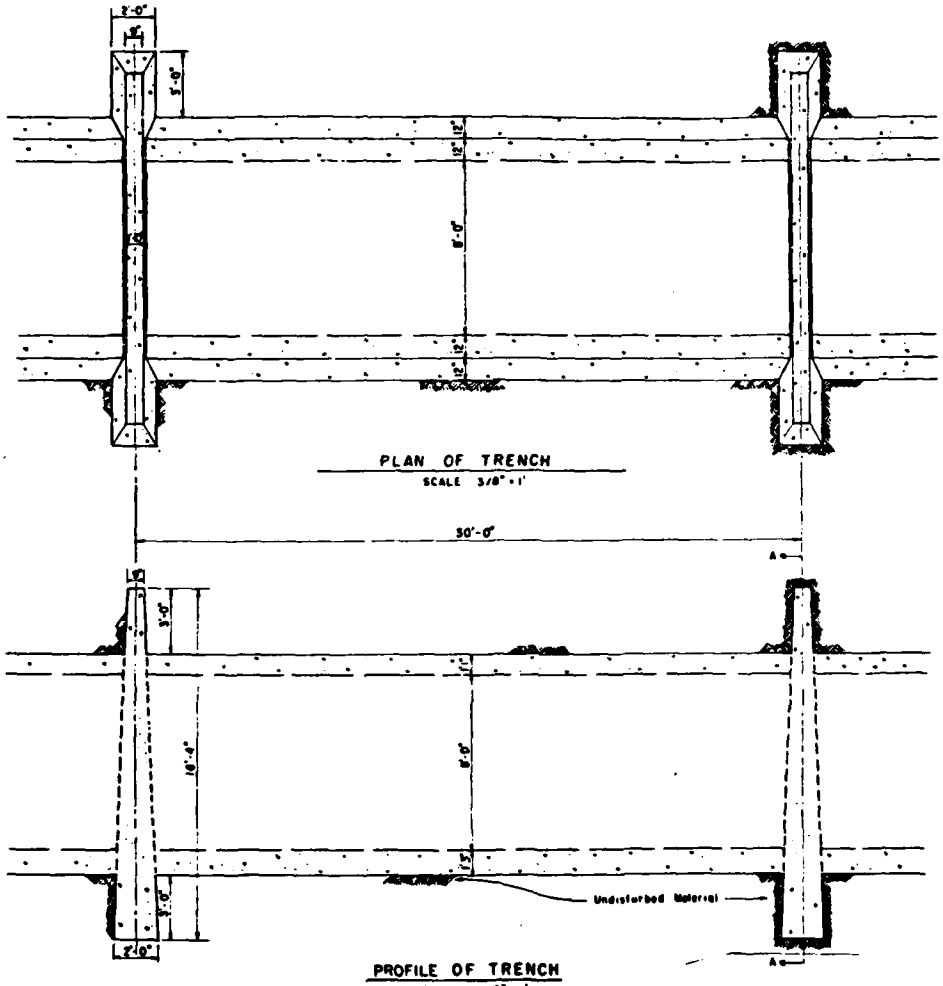


STOCK FILE

RECEIVED
JUN 29 1981
7101

MERIDIAN ENGINEERING INC 1776 BENJAMIN FRANKLIN PARKWAY, PHILADELPHIA, PA PROJECT MANAGERS AND ENGINEERS	TOWN CENTER DAM NEWTOWN TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA	PLAN SPILLWAY SYSTEM	DATE: JUNE, 1978 SCALE: 1" = 100' JOB NO: MY-0630 DRAWN: CS CHKD BY: JD APPD: GPS
PICKERING, CORTS & SUMMERSON, INC 5 STATE STREET NEWTOWN, PENNSYLVANIA CONSULTING ENGINEERS	THE M A KRAVITZ COMPANY INC 160 N GULF ROAD, KING OF PRUSSIA, PENNSYLVANIA PROJECT DEVELOPERS		SHEET 3 of 9

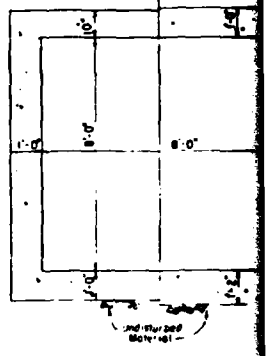
PLATE 3



PLAN OF TRENCH
SCALE 3/8" = 1'

PROFILE OF TRENCH
SCALE 3/8" = 1'

TYPE I

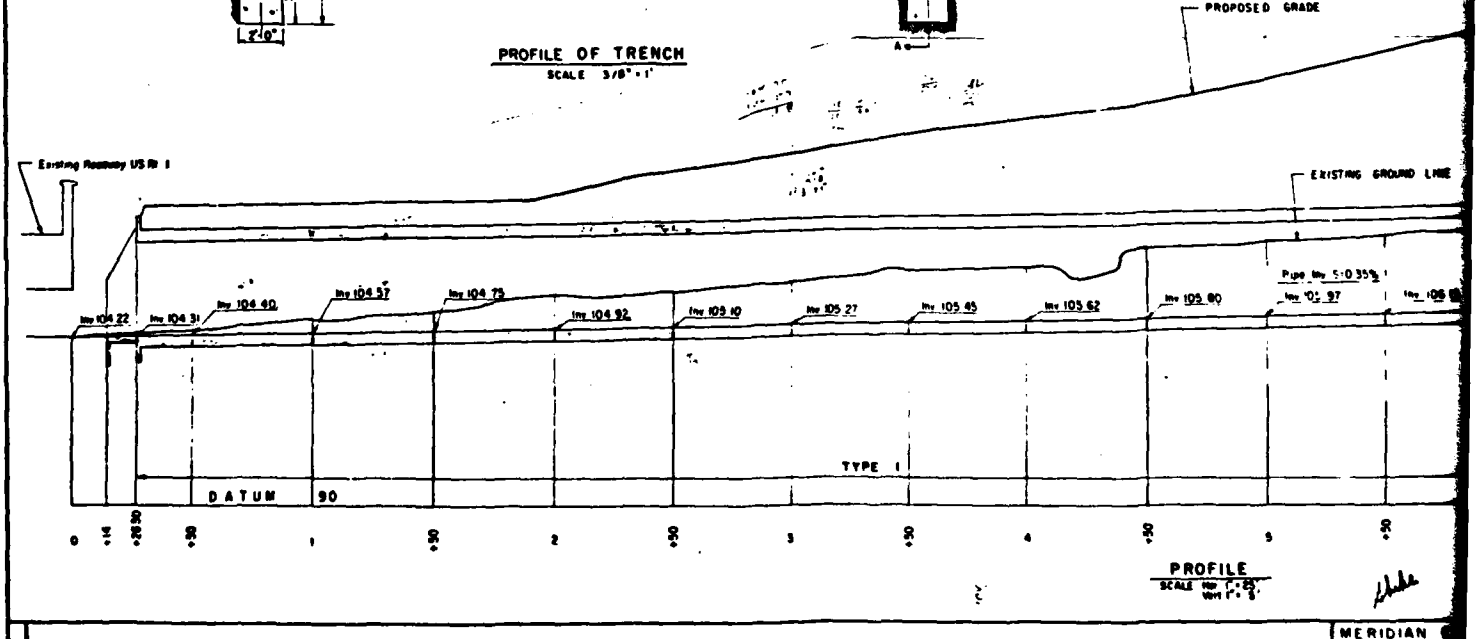


DISCHARGE CONDUI
SCALE 1/2" = 1'

NOTE
All Construction
Requirements of Form W
for Construction, Comm
of Forests and Waters
Resources), Bureau of E

6" of Top Soil @ S
Slopes of the Dam Embo

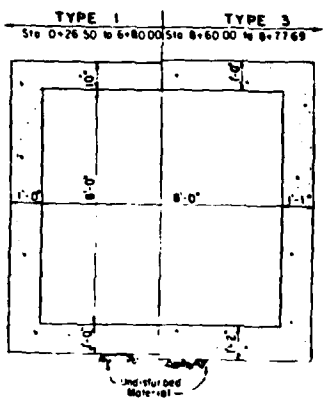
Impervious Material
soil characteristics
Engineers, Inc., File No



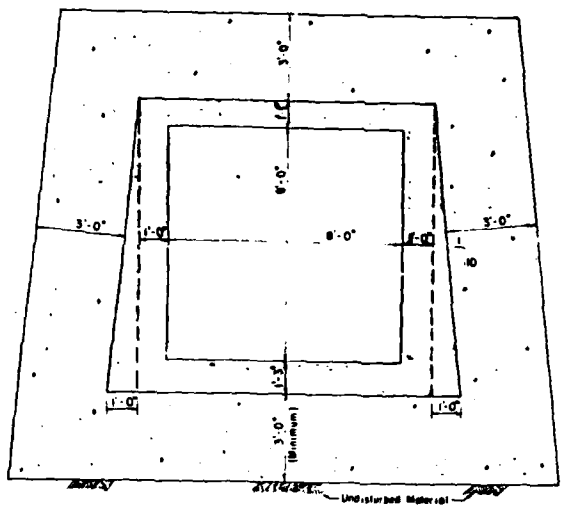
PROFILE
SCALE Hor. 1" = 50'
Vert 1" = 5'

7S7-5111

MERIDIAN
PROJECT
PICKERING, CO
CONSUL



DISCHARGE CONDUIT
SCALE 1/2" = 1'



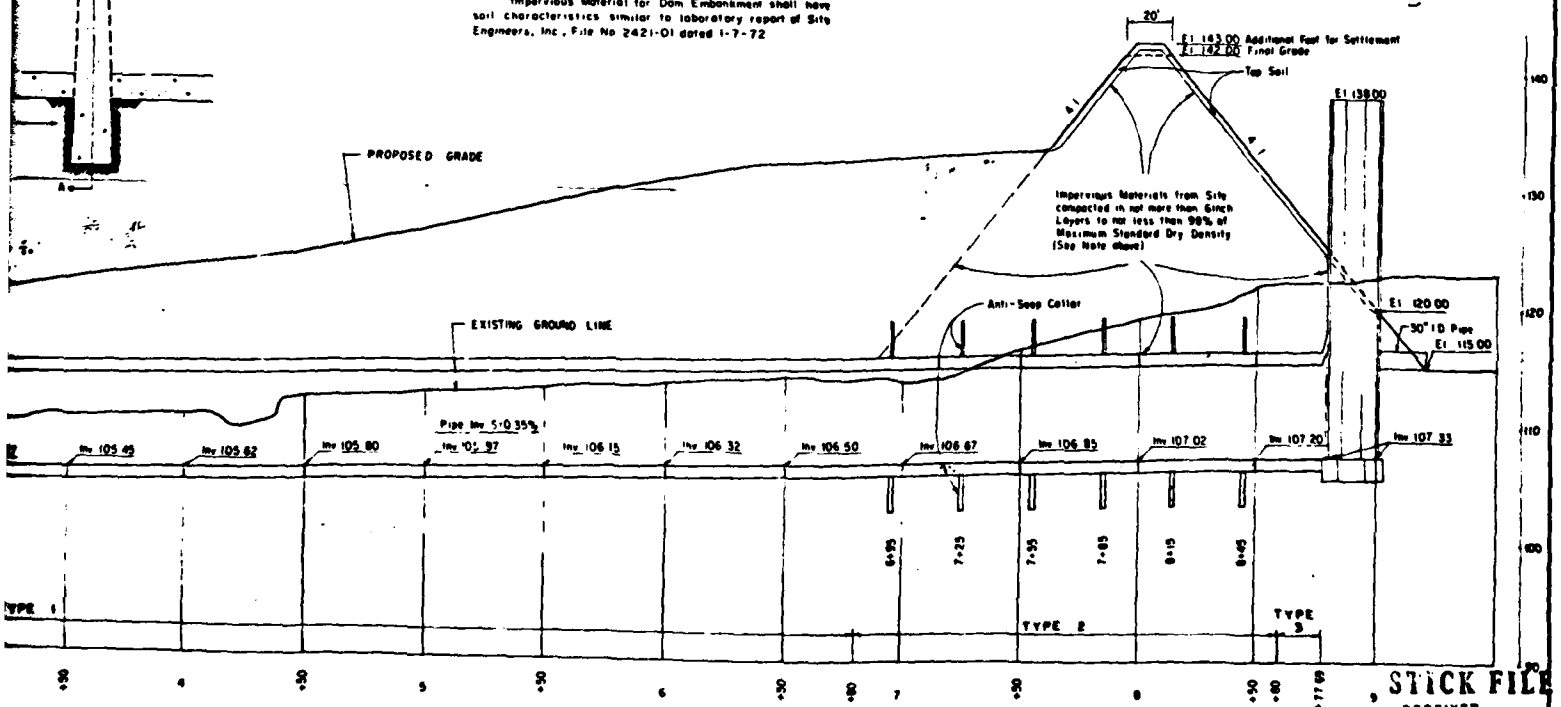
DISCHARGE CONDUIT TYPE 2 WITH ANTI-SEEP COLLAR
SECTION A-A
SCALE 1/2" = 1'

NOTE

All Construction shall conform to the Construction Requirements of Form WCE-5 *Standard Specifications* for Construction, Commonwealth of Pennsylvania, Department of Forests and Waters (now Department of Environmental Resources), Bureau of Engineering

6" of Top Soil & Seed shall be placed on the 4:1 Slopes of the Dam Embankment

Impervious Material for Dam Embankment shall have soil characteristics similar to laboratory report of Site Engineers, Inc., File No 2421-01 dated 1-7-72

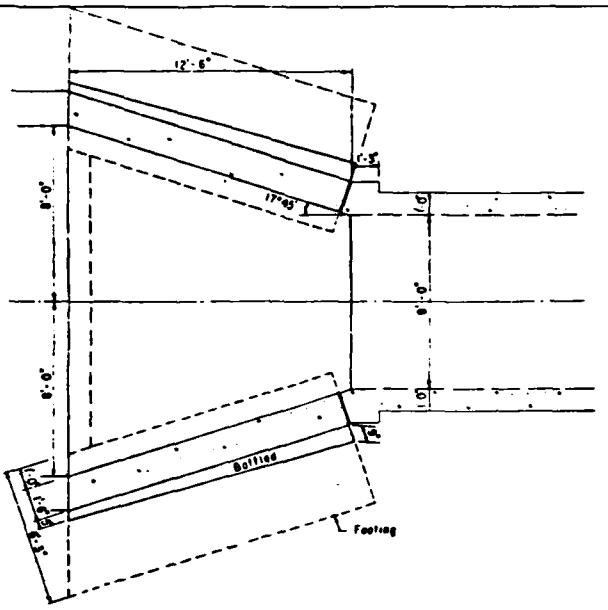


PROFILE
SCALE Hor 1" = 25'
Vert 1" = 5'

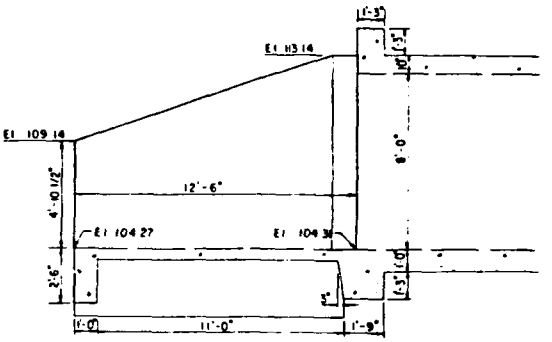
STICK FILE
RECEIVED
JUN 28 1972
7101

75-5111	MERIDIAN ENGINEERING INC PROJECT MANAGERS AND ENGINEERS PICKERING, CORTS & SUMMERSON, INC CONSULTING ENGINEERS	TOWN CENTER DAM THE M A KRAVITZ COMPANY INC PROJECT DEVELOPERS	PROFILE & DETAILS SPILLWAY SYSTEM	DATE JUNE, 1972 SCALE AS NOTED JOB NO MY-0630 DRAWN CG CHK'D JO APPD APS	SHT 4 of 9

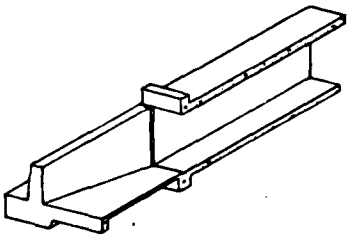
PLATE 4



DISCHARGE TRANSITION
PLAN
SCALE 3/8" = 1'

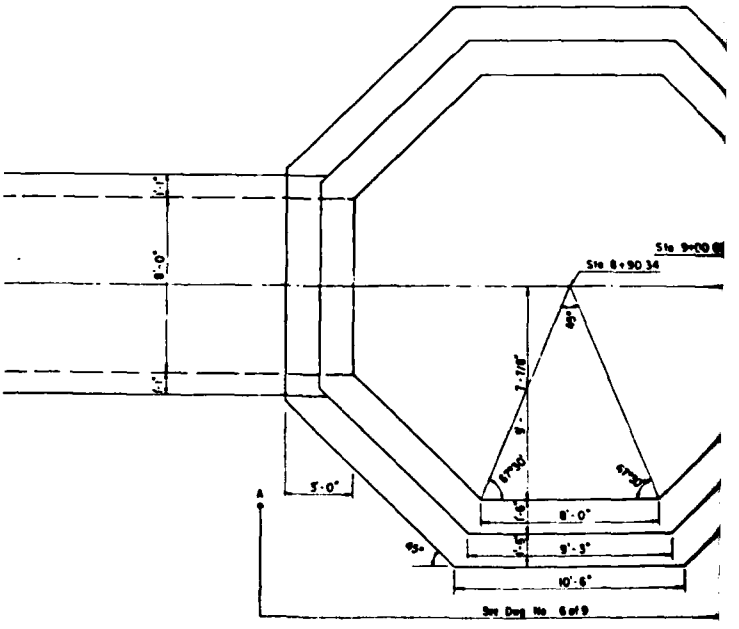


DISCHARGE TRANSITION
PROFILE
SCALE 3/8" = 1'



DISCHARGE STRUCTURE
HALF - ISOMETRIC
NO SCALE

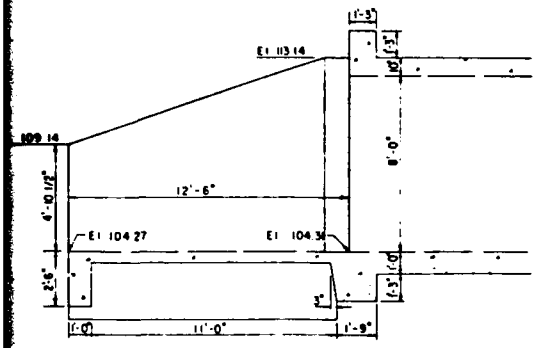
NOTE
End of Transition - Discharge Structure, Sta 0+14, will connect to Extension of Drainage Structure at U S Route No 1



INTAKE STRUCTURE
PLAN
SCALE 3/8" = 1'

MERIDIAN ENGI
PROJECT MANAGERS

PICKERING, CORTS &
CONSULTING



DISCHARGE TRANSITION
PROFILE
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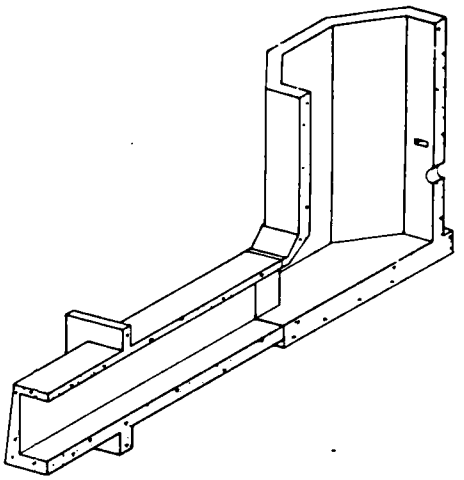
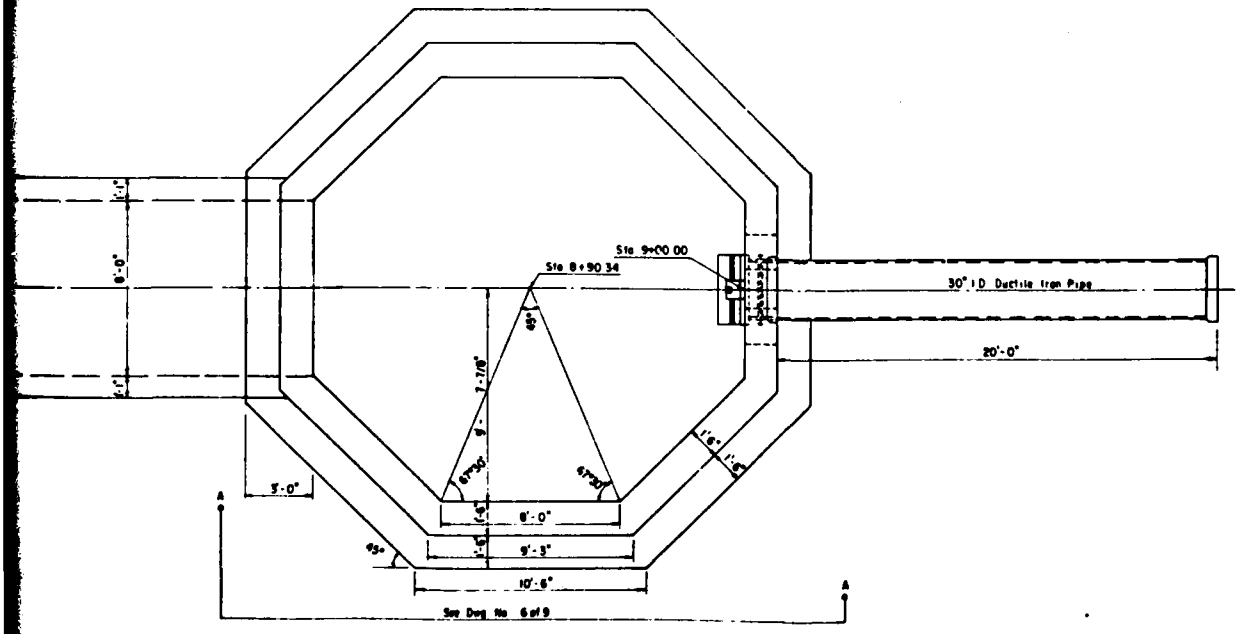


INTAKE STRUCTURE
HALF - ISOMETRIC
NO SCALE



INTAKE STRUCTURE
PLAN
SCALE 3/8" = 1'

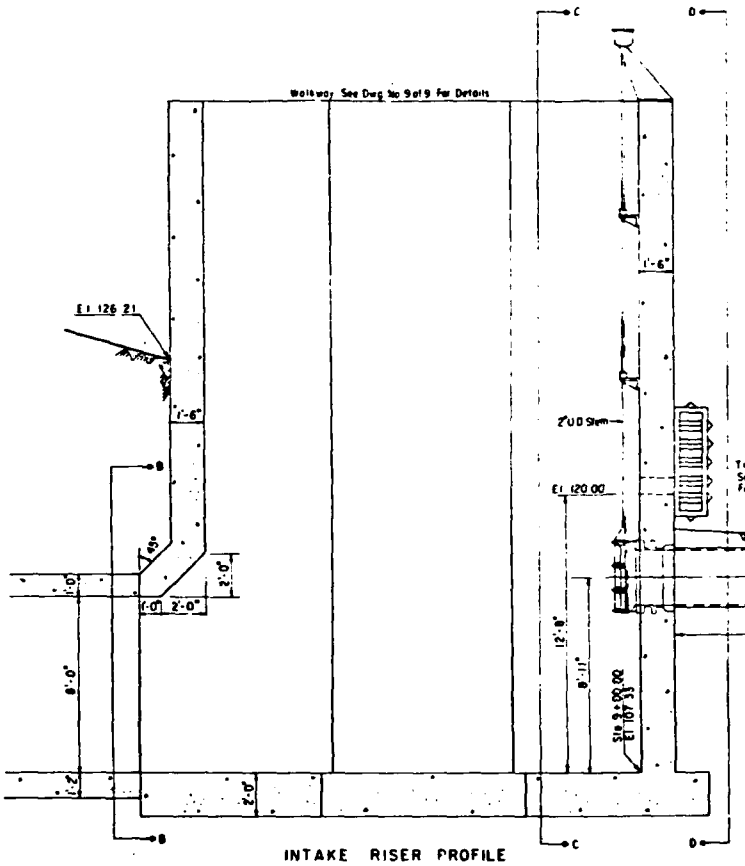
STICK FILE

RECEIVED
JUN 29
JOB NO 2161

MERIDIAN ENGINEERING INC 1776 BENJAMIN FRANKLIN PARKWAY, PHILADELPHIA PA PROJECT MANAGERS AND ENGINEERS	TOWN CENTER DAM MIDDLETOWN TOWNSHIP, BUCKS COUNTY PENNSYLVANIA	DETAILS DISCHARGE TRANSITION STRUCTURE & INTAKE RISER	DATE	JUNE, 1972
			SCALE	AS NOTED
PICKERING, CORTS & SUMMERSON, INC 5 STATE STREET NEWTOWN PENNSYLVANIA CONSULTING ENGINEERS	THE M A KRAVITZ COMPANY INC 1601 S GULF ROAD KING OF PRUSSIA, PENNSYLVANIA PROJECT DEVELOPERS		JOB NO	MV 0630
			DRAWN	CS
			CHKD	JD
			APPD	APS

SHEET 5 of 9

PLATE 5



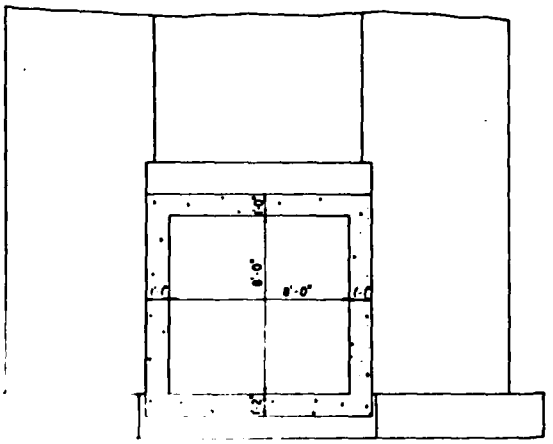
INTAKE RISER PROFILE

SCALE 3/8" = 1'

NOTE

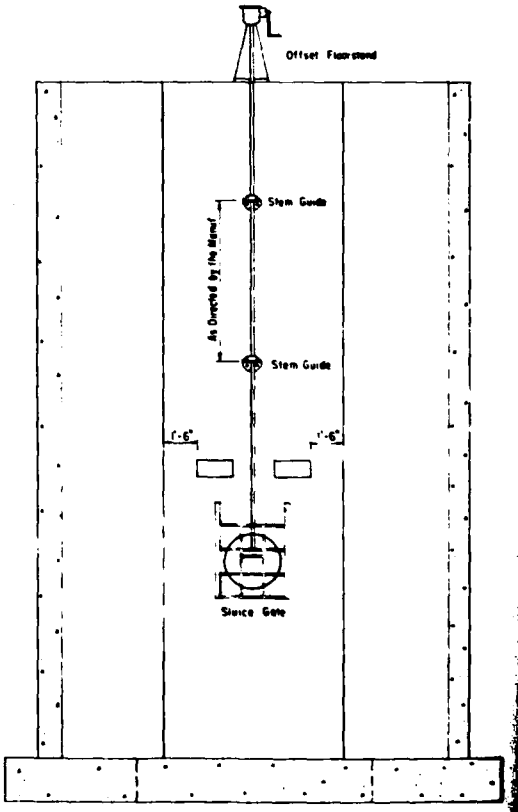
The following Equipment shall be as manufactured by the Rodney Hunt Company, or approved equal 30" x 30" Sluice Gate (80M, 05-5002 Offset Type Floor Stand, all necessary Operating Stems, Stem Couplings, Stem Guides, Anchor Bolts, Flange and Bell Thimble with Cut Off Collar, and Rising-Stem Pipe Cover

All dimensions pertaining to Sluice Gate shall be as recommended by the Manufacture



SECTION B-B

SCALE 3/8" = 1'



SECTION C-C

SCALE 3/8" = 1'

MERIDIAN ENGI

PROJECT MANAGERS

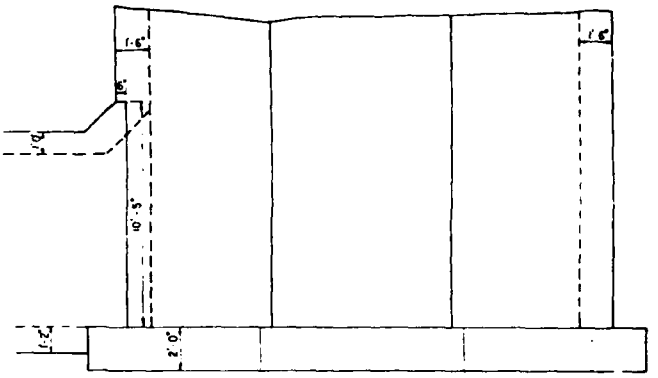
PICKERING, CORTS &

CONSULTING

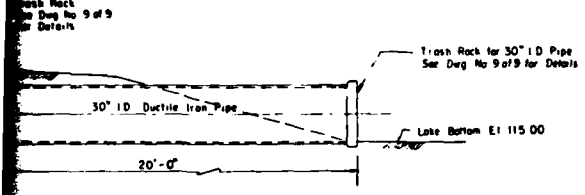
NOTE

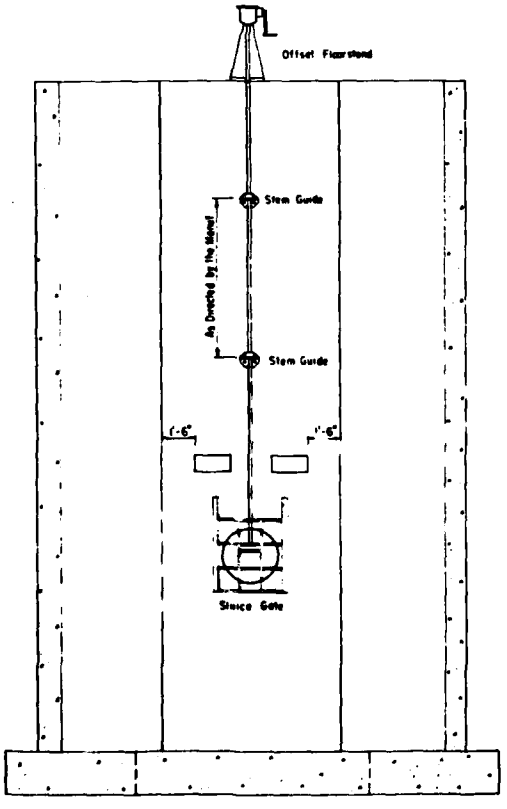
The following Equipment shall be as manufactured by the Rodney Hunt Company, or approved equal 30" x 30" Sluice Gate 180M, 05-5002 Offset Type Floor Stand, all necessary Operating Stems, Stem Couplings, Stem Guides, Anchor Bolts, Flange and Bell Thimble with Cut Off Collar, and Rising - Stem Pipe Cover

All dimensions pertaining to Sluice Gate shall be as recommended by the Manufacture

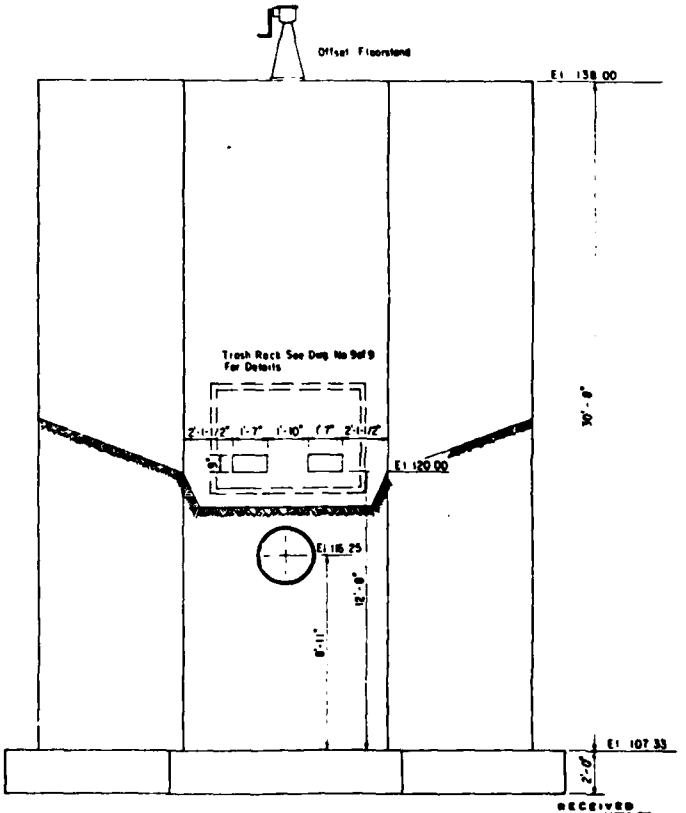


SECTION A-A
SCALE 3/8" = 1'





SECTION C-C
SCALE 3/8" = 1'



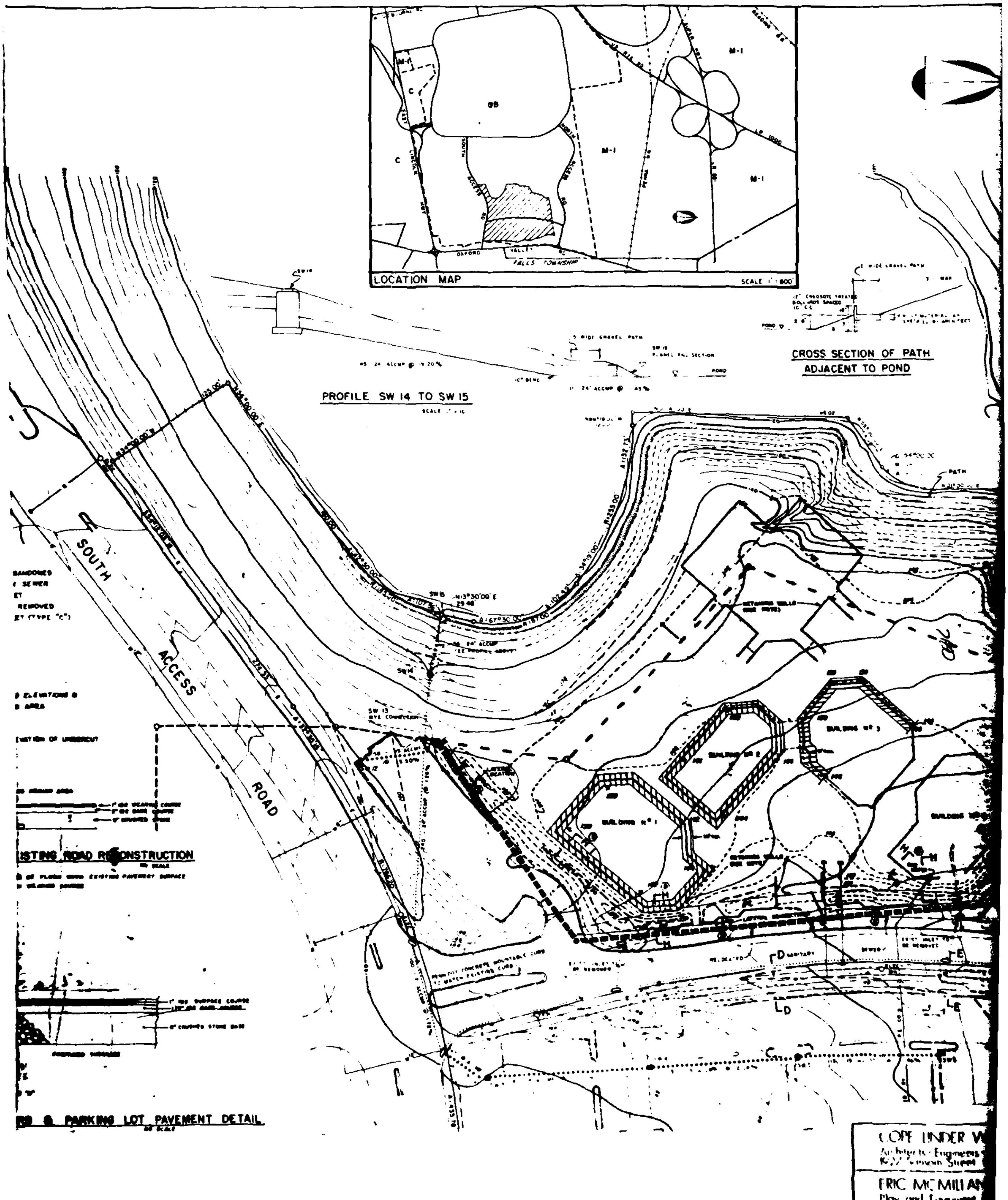
SECTION D-D
SCALE 3/8" = 1'

RECEIVED
APR 29 1972

STICK FILE 210

MERIDIAN ENGINEERING INC PROJECT MANAGERS AND ENGINEERS	TOWN CENTER DAM	DETAILS INTAKE RISER	JUNE, 1972 AS NOTED CG JO	6 of 9
PICKERING, CORTS & SUMMERSON, INC CONSULTING ENGINEERS	THE M A KRAVITZ COMPANY INC PROJECT DEVELOPERS			

PLATE 6


LOCATION MAP
FALLS TOWNSHIP
PROFILE SW 14 TO SW 15
CROSS SECTION OF PATH
ADJACENT TO POND
SOUTH
ACCESS
ROAD
BUILDING Nº 1
BUILDING Nº 2
BUILDING Nº 3
ISTING ROAD RECONSTRUCTION
PARKING LOT PAVEMENT DETAIL
COPE LINDER W
ERIC MCMILLAN

Revision	Description
1	REVISED DIRECTION OF TWP. ENG.
2	GENERAL REVISIONS
3	GRADING REVISIONS TO BALANCE EARTH WORK
4	REVISED SECTION D-D'
5	REVISED UNDERCUT ZONE
6	REVISED GRADING AROUND BLDGS. 1, 2 & 3
7	REVISED GRADING AT SERVICE ENTRANCE TO BLDG 4
8	REVISED GRADING ADJACENT TO BLDG 1 & 4 AT NORTH ENTRY
9	RELOCATED UTILITIES PER REVISED DWG. UPA 1
10	REVISED NORTH EAST CORNER OF EAST PARKING LOT

MIDDLETOWN TOWNSHIP, BUCKS COUNTY, PENNSYLVANIA

COPE LINDER WAIMSLEY
Architects · Engineers · Landscape Architects
1927 Samson Street Philadelphia Pa 19103

ERIC MCMILLAN INC
Play and Equipment Design
360 Adelaide Street East, Toronto, Canada

SESAME PLACE
Bucks Town Center Parcel 3
Middletown Township Pennsylvania

CTW PARKS INC.
1 Lincoln Plaza New York New York

LAND DEVELOPMENT PLAN · GRADING

ROBERT F. HARSCH & ASSOCIATES, INC.
CONSULTING ENGINEERS
333 N. Walnut St. West Chester, Penna. 19380/215-696-1035

Sheet 1 of 6

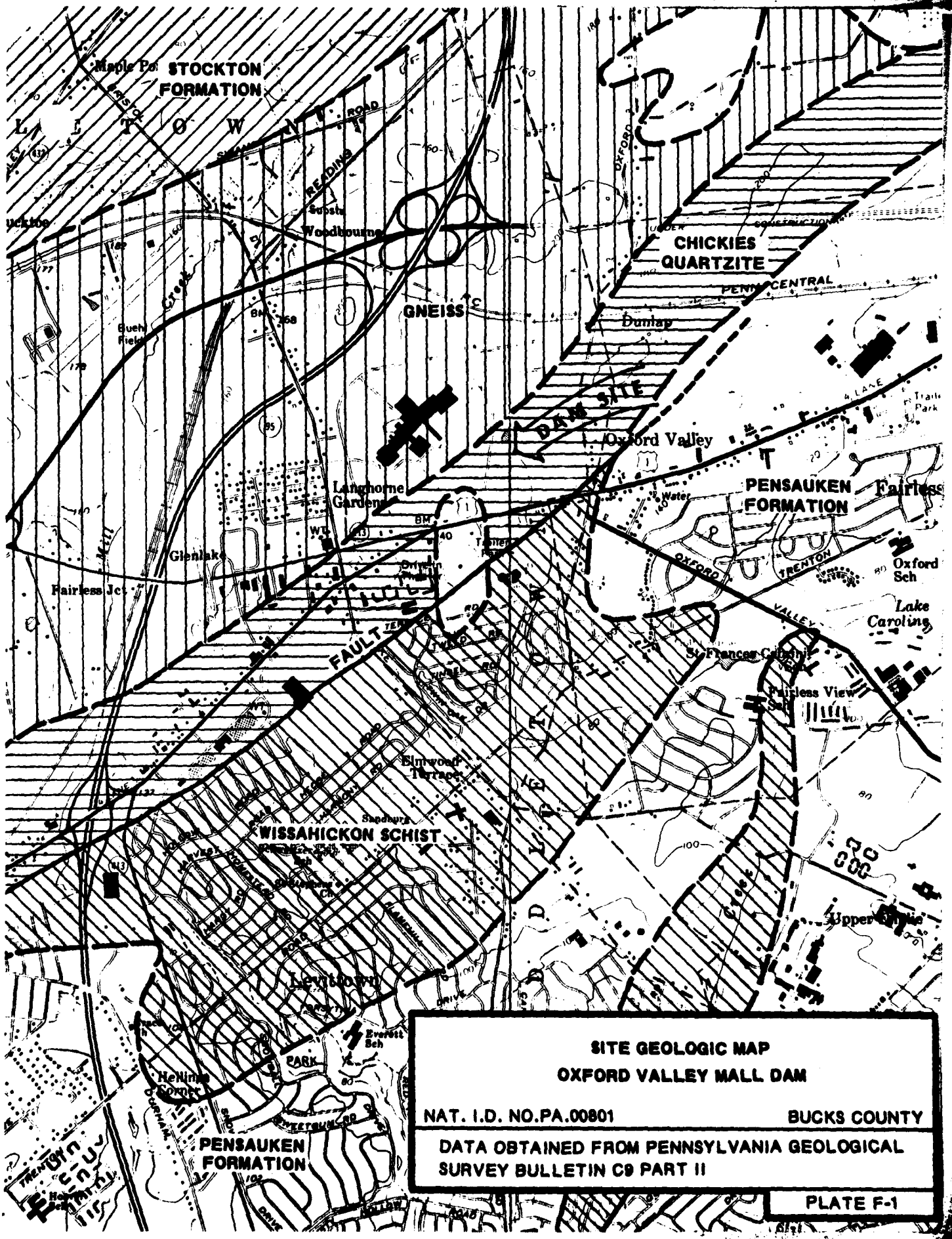
PLATE 7

APPENDIX

F

SITE GEOLOGY
OXFORD VALLEY MALL DAM

The Oxford Valley Mall Dam is located in the Piedmont Uplands Section of the Piedmont Physiographic Province. This region is bordered by the Triassic Lowlands Section immediately to the northwest and by the Coastal Plain Pnysiographic Province immediately to the southeast. As shown in Plate F-1, the dam is situated approximately midway within a 2,000 foot wide northeast-southwest trending belt of Chickies Quartzite. This early Cambrian age formation consists of light gray, hard quartzite and quartz schist. Information contained in State files describes the bedrock as either decomposed mica schist or sandy mica schist being encountered generally from 5 to 10 feet in borings. No bedrock exposures were observed during the field inspection. The strike of bedding would be expected to be to the northeast with varying dip. A regional northeast striking fault passes within 1,000 feet to the southeast of the dam.



SITE GEOLOGIC MAP

OXFORD VALLEY MALL DAM

NAT. I.D. NO.PA.00801 BUCKS COUNTY

DATA OBTAINED FROM PENNSYLVANIA GEOLOGICAL SURVEY BULLETIN C9 PART II

PLATE F-1